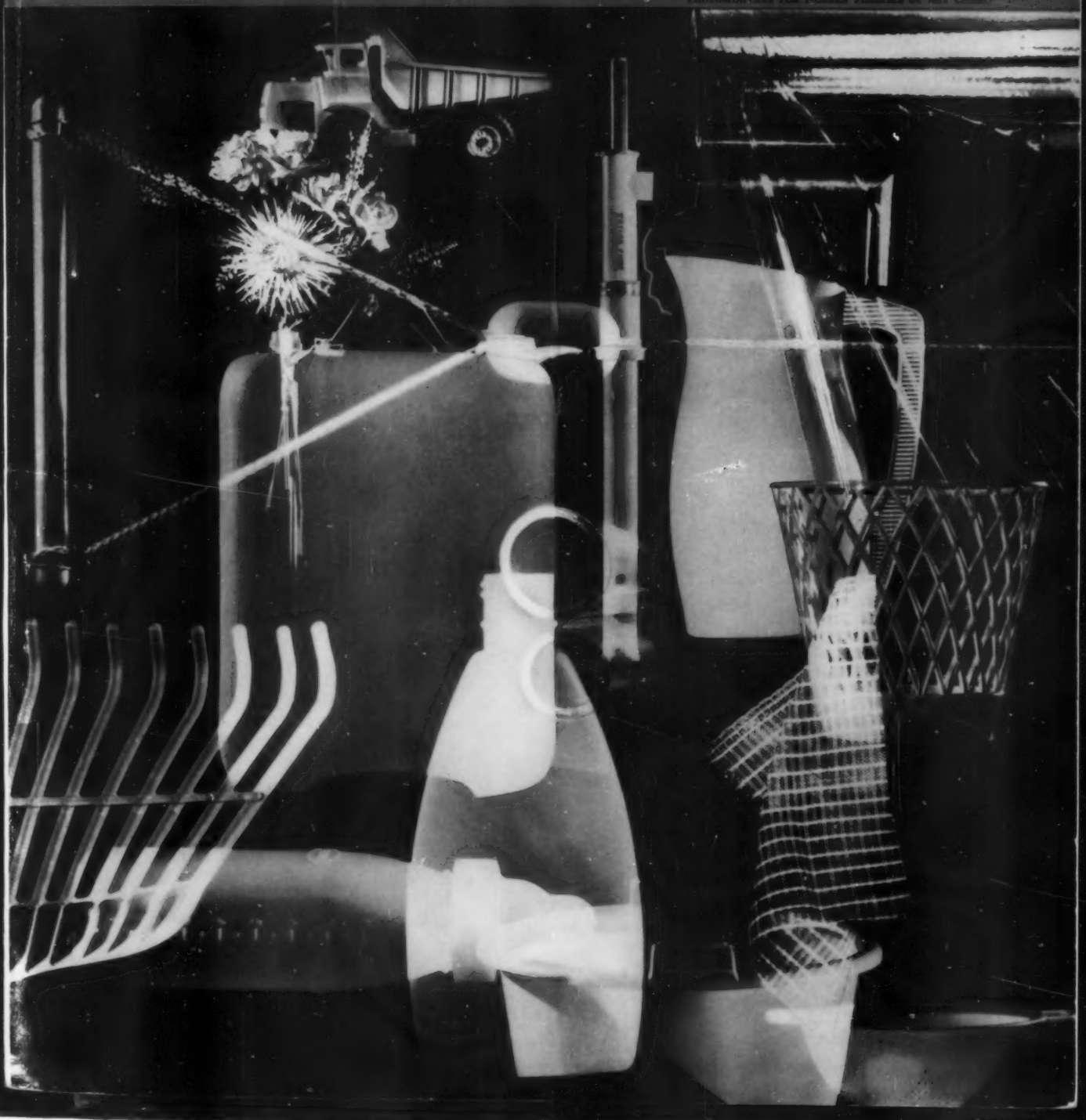
MODERN PLASTICS

OCTOBER 1958

How to know what you need in polyethylene page 83

Learn to coat metals with fluidized plastics page 125

PHOTOMONTAGE FOR MODERN PLASTICS BY RAY CHERRY



TO BRIGHTEN UP YOUR PRODUCT

Color helps sell these new Sunbeam electric fry pans and other Sunbeam Corporation appliances.

Where do you want to put the selling power of *color* to work in your product?

Now you can get rigid, strong parts like these *in a whole spectrum of opaque, light-fast colors.* How? With a new, amazingly durable plastic molding material—*Durez polyester.*

These parts combine rugged strength with other qualities you'll find in no other color plastic. Their electrical properties are outstanding. They're inherently fire-resistant—meet Underwriters' requirements for appliances.

You can use Durez polyester in many places where you can't use other plastics, because *molded parts show virtually no change in dimensions after molding!*

Your molder can get this new plastic now in a variety of standard colors. It comes in a dry granular form and is easily molded on standard presses with compression or transfer molds.

If you'd like to brighten up your product with strong, dimensionally stable parts like these, ask us for illustrated Bulletin 200. It shows how leading manufacturers are using Durez polyester to spur sales of consumer products. Write DUREZ PLASTICS DIVISION, Hooker Chemical Corporation, 1210 Walck Road, North Tonawanda, New York.

Solves shrinkage problem! These parts for Singer Sewing Machine Co., molded from Durez polyesters, retain their shape better than any other color plastic. Parts fit together better for faster assembly, fewer rejects.

DUREZ®

HOOKER CHEMICALS PLASTICS

PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION

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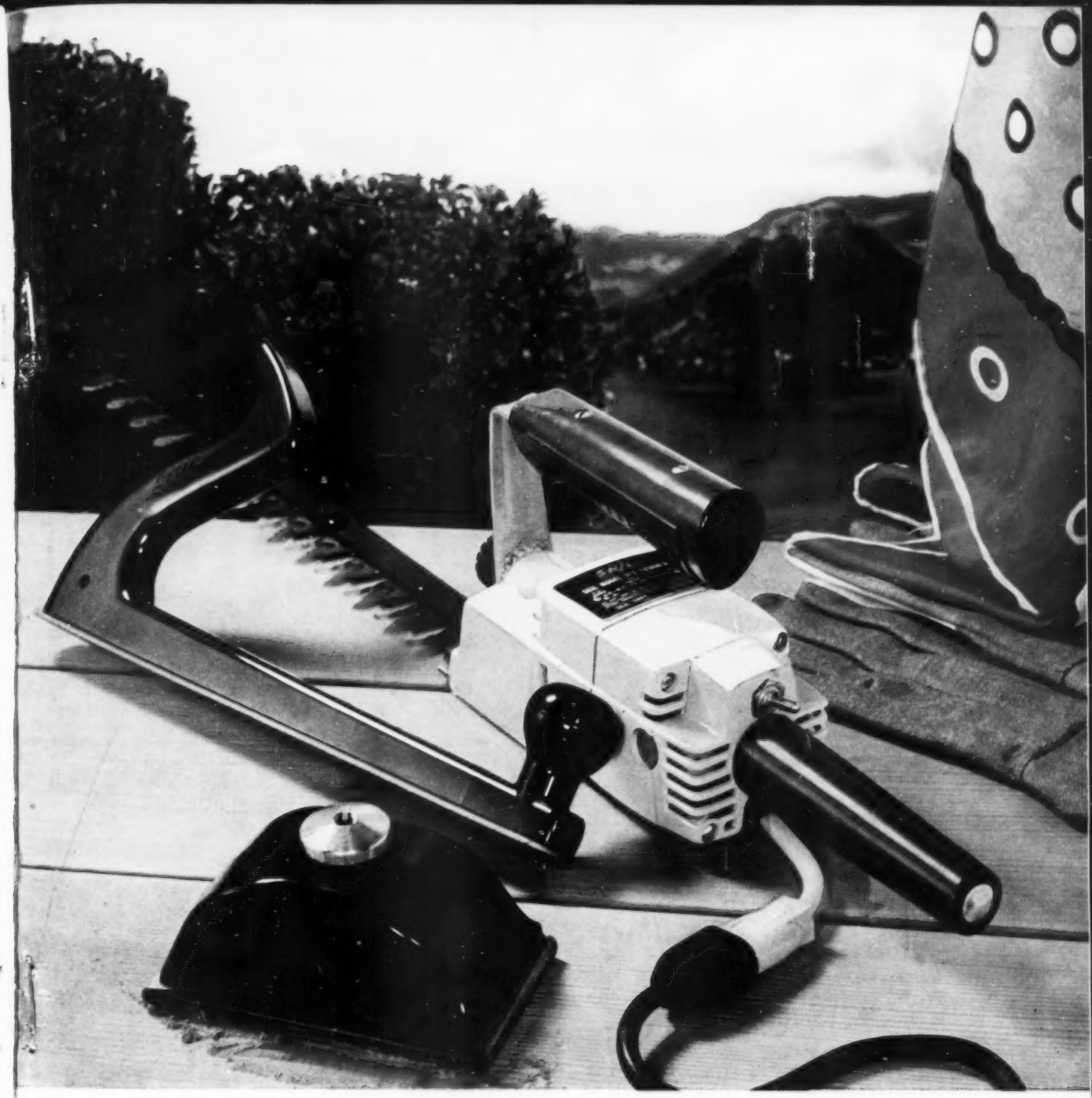

SKIL switches to Catalin MEDIUM AND HIGH IMPACT STYRENE

As new as tomorrow morning's newscast are these tools for the home-owner by SKIL.* The powerful, fast-cutting trimmer embodies advanced principles of design to make the garden-lover's hedge-tasks light and pleasurable. And for the hobbyist and fix-it fancier, the hand sander and sander-plane, equipped with the completely new Perma-Grit abrasive sheets, are welcome additions to the home workshop.

Progressive manufacturers like SKIL Corporation periodically re-evaluate design and materials for improving their products. In the case of the three items shown, by switching the material of the handles from a compression molded thermoset to injection molded medium and high impact CATALIN STYRENE, SKIL improved their impact strength considerably *at lower cost.*

If the design of your product includes—or can include—plastic components, weigh carefully the possibility of upgrading quality at equal or lower cost by switching to a suitable choice among Catalin's comprehensive range of thermoplastics . . . medium, high or super-high impact *polystyrenes*, high to low density *polyethylenes*, or *nylon* molding and extrusion compounds. Inquiries invited.

**Handles are custom molded by Kvolyn Plastics, Inc. for SKIL Corporation, both of Chicago, Ill.*

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NOVEMBER 17-21
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In addition to Styrene, Polyethylene and Nylon Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, and Melamine Resin formulations

MODERN PLASTICS*

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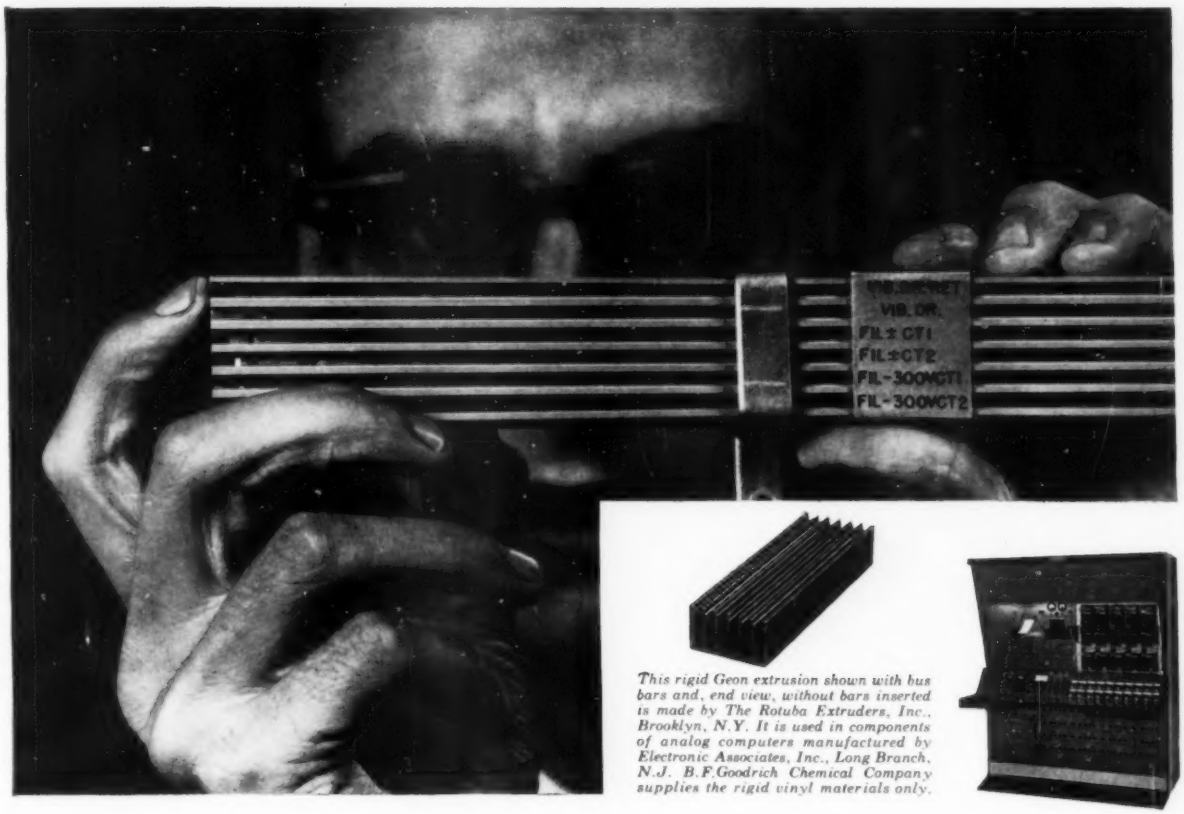
Another new development using

B.F.Goodrich Chemical *raw materials*



This rigid Geon extrusion shown with bus bars and, end view, without bars inserted is made by The Rotuba Extruders, Inc., Brooklyn, N.Y. It is used in components of analog computers manufactured by Electronic Associates, Inc., Long Branch, N.J. B.F.Goodrich Chemical Company supplies the rigid vinyl materials only.

Extrusion of rigid Geon

. . . cuts bus bar insulation costs, saves assembly time

This extrusion of Geon rigid vinyl material saves cost, time and space for electrical assemblies. It is used to retain and insulate six strip-type bus bars of varying voltages up to 600 volts DC. They can be placed closer together because of rigid Geon's high dielectric strength and high insulation value.

Rigid Geon brings material costs down, too, for this application. It also shortens assembly time and saves weight and space.

In addition, the use of extrusions made from Geon rigid vinyl material provides good chemical and abrasion resistance. If desired, they can be colored for coding purposes. It's another example of the way Geon rigid vinyl can be the key to a new or improved product or application. For information, write Dept. LE-10, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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GEON polyvinyl materials • HYCAR American rubber and latex
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1 Nylon replaces metal in this idling cam made by Chicago Molded for Holley Carburetor. By injection molding it of nylon, Chicago Molded eliminated 3 operations—hardening, stamping and assembly. *This cuts production costs 50%.* Chicago Molded went even further and designed a unique mold with removable sections. This represents advance planning for easy changes in the number and sizes of the ratchets at lowest expense. Picture how this kind of foresight could keep your costs down.

2 One part replaces three in this paint spray gun body developed with the help of Chicago Molded. By injection molding it from nylon as a single part, Chicago Molded eliminated several machining, polishing, buffing and plating operations previously required for metal guns. In addition to the cost-cutting advantages of this new nylon design, it is two-thirds lighter, is not affected by solvents, and makes a tighter air seal than die-cast aluminum. Do you have a similar part or component?

4 ways *Chicago Molded might cut your parts costs*

3 This new "Schlitztap" looks like expensive bone china, but it's actually made of melamine. Engineered and molded by CMPC, the plastic parts of the "Schlitztap" not only cost less than their ceramic counterparts but are almost indestructible. They're immune to perspiration, scratching, staining and chipping. This is the first time that it has been practical to duplicate decorated ceramics that have compound curved surfaces.

4 An injection-molded—31″ x 16″—styrene cover replaces a die cast part at a lower cost in this Magna Bandsaw. Furthermore, the color's *in* the plastic, eliminating the cost of painting during manufacture. And the cover can't chip, peel, or fade. Chicago Molded's engineers can suggest ways to make good products better *and at lower cost* through the use of molded plastic parts.

LET CHICAGO MOLDED KNOW YOUR COST PROBLEMS
It may be possible to solve them and make a better product too—with a slight change in design, or material, suggested by Chicago Molded. Our engineers have exceptional experience in doing just this. Your problems are their job. So let us know if we can be of help. Contact:

CHICAGO MOLDED
PRODUCTS CORPORATION
1032 North Kolmar Ave., Chicago 51, Ill.

Editorial

How to help a student

The 1959 MODERN PLASTICS Encyclopedia Issue is now off the presses and is being bound and delivered to subscribers.

We are rather proud of this new issue because, with wonderful cooperation from the industry, we are able to cover all the new developments in materials, processes, and equipment in a year of fast-breaking plastics news. We believe readers will find the beautiful new Plastics Properties Charts in this issue much easier to read and use. A new section on Planning the Plastic Product is the result of reader demands. Articles on Designing for Plastics and on Cost Estimating for Plastics will, we are sure, prove useful to processors and end-users alike.

For the past several years a return post card has been placed in each copy of the MODERN PLASTICS Encyclopedia Issue inviting readers to send their previous year's copies to university students interested in plastics. The subscriber merely put the old book into the box in which he received his new copy, stuck on a label supplied by us, addressed to a student in one of 20 universities, and mailed it out.

Well over 12,000 copies of earlier Encyclopedia issues have been so distributed, thanks to cooperating subscribers.

Letters from university professors and students are enthusiastically grateful in tone, and we have many reports of letters from students to our subscribers in the same vein. We feel that this is a most worthwhile program on the part of subscribers and ourselves because it helps to educate tomorrow's business leaders and provides for dissemination of information on plastics that would not otherwise be financially possible.

This year the customary return post card has not been included. So, on behalf of these students we make the following request to subscribers: If you are willing to donate your last year's MODERN PLASTICS Encyclopedia Issue to a university student, please drop a note to the editor. By return mail you will receive a label addressed to some student. On receipt of your new 1959 Encyclopedia Issue, replace it in the package with your last year's copy, attach the label, and put it in the mails.

Our best thanks in advance to all subscribers for their kind cooperation in this matter.

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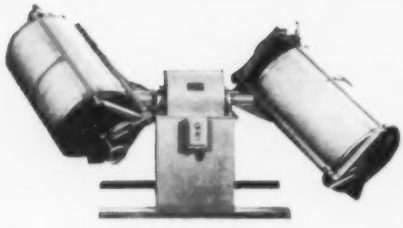
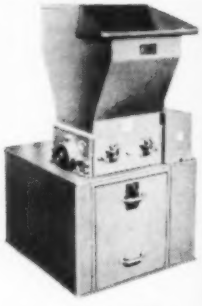


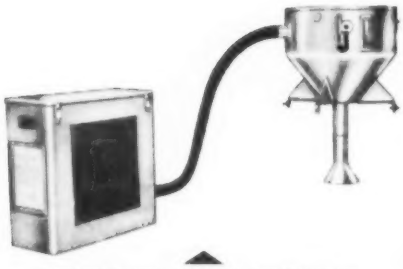
DRUM TUMBLER
Floor level loading. Accommodate 28" to 33" drums. Ball bearing equipped. Extra heavy steel construction throughout.



MARVEL SERIES GRANULATOR
Models with capacities from 75 to 500 pounds an hour. Constructed of steel.

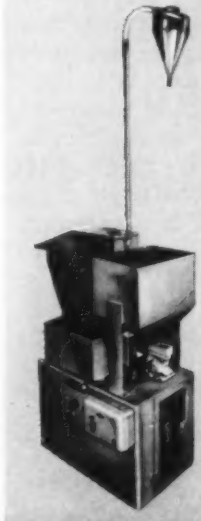
GRANULATORS

HEATER-DRYERS, PELLETIZERS, BLENDERS AND DRUM TUMBLERS, TOO



HEATER-DRYER (HOPPER ATTACHMENT)
Disperses moisture and preconditions material. Helps eliminate rejects and increase production. Steel or Stainless Steel Construction.

BLENDER-LOADAMATIC
Mixes virgin material with regrind as the regrind is generated, then loads mixed material into extruder or molding machine hopper.



Performance counts . . . and, on-the-job, B&J Granulators outperform all others of comparable size and cost. For beside-the press, you can't beat B&J Marvel Series Granulators —built entirely of steel with capacities up to 500 pounds an hour. For large volume batch grinding or for handling the toughest thermoplastics, your best buy is a B&J Steelmaster Granulator. For intermediate requirements, there are many other models to choose from. Compare performance . . . compare construction . . . compare cost—you'll see why Ball & Jewell has been the leader in granulating machines for more than 60 years.

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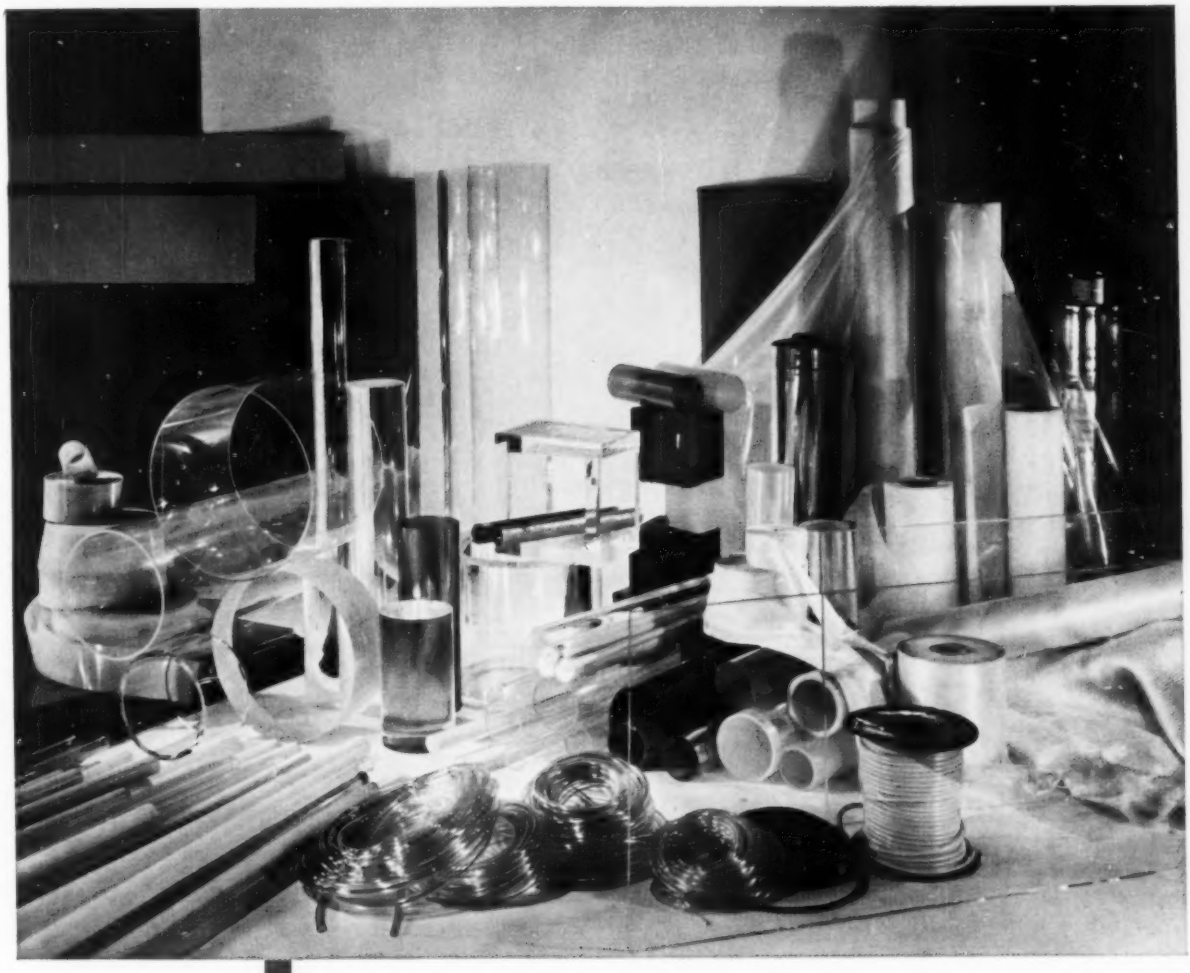

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are all the name implies—and more!

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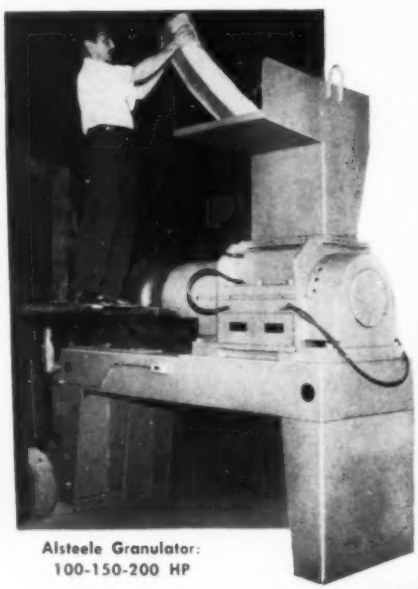

Alsteele Granulator: 100-150-200 HP

Beside-the-Press Granulators in a complete range of sizes

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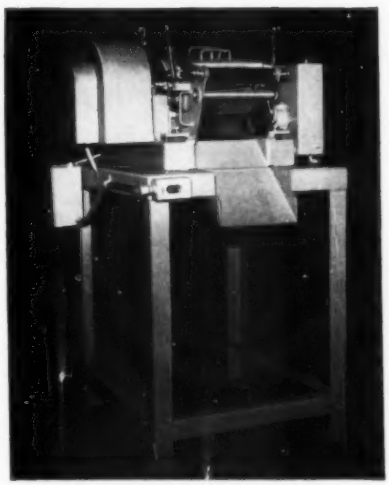
Additional features are excellent uniformity of pellets, and clean cutting action—even on elastomerics. A greatly lowered noise level is still another benefit.



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Flow temperature: (°C.) (A.S.T.M.)	D569-48	145–183
Specific gravity	D176-42T	1.18–1.21
Tensile properties:		
Break (p.s.i.)	D638-52T	1900–5900
Elongation (%)	D638-52T	48–63
Flexural properties:		
Flexural strength (p.s.i. at break)	D790-49T	3300–10700
Rockwell hardness: (R scale)	D785-51	+15–106
Izod impact: (ft. lb. in. notch)	D256-43T	2.7–11.0
Heat distortion: (°C.)	D648-45T	51–70
Water absorption:		
% sol. lost	D570-42	0.00–0.08
% moisture gain	D570-42	1.5–1.8
% water absorption	D570-42	1.6–2.0

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Dept. 101-J, 744 Broad Street, Newark 2, N. J.

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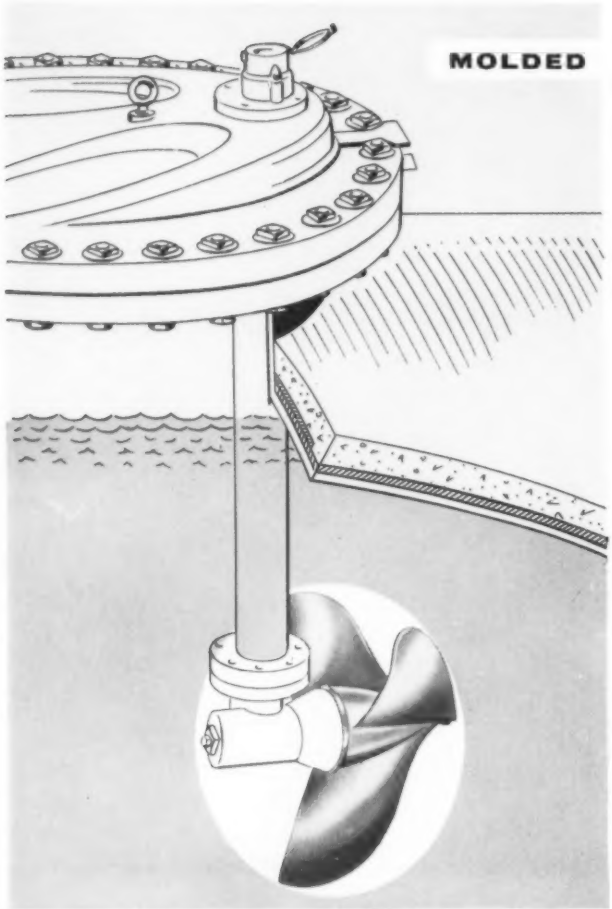
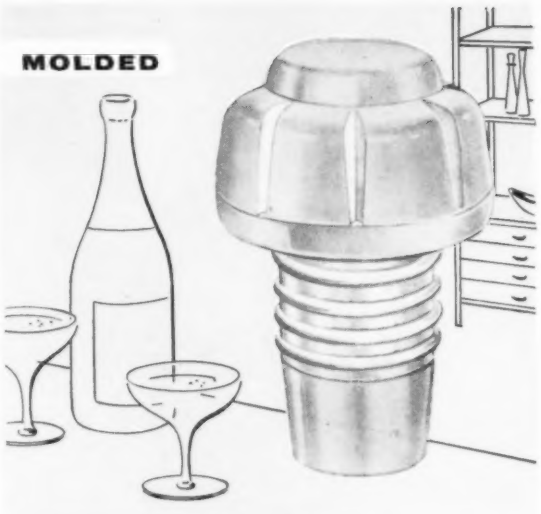


PROPELLERS for water meters are molded of lightweight ALATHON 10 to reduce bearing load and wear. The flexible propellers throw off foreign materials, minimize fracturing. Long service is assured by resistance of ALATHON to chemical and electrolytic action. (Manufactured by Sparling Meter Co., El Monte, Calif.)

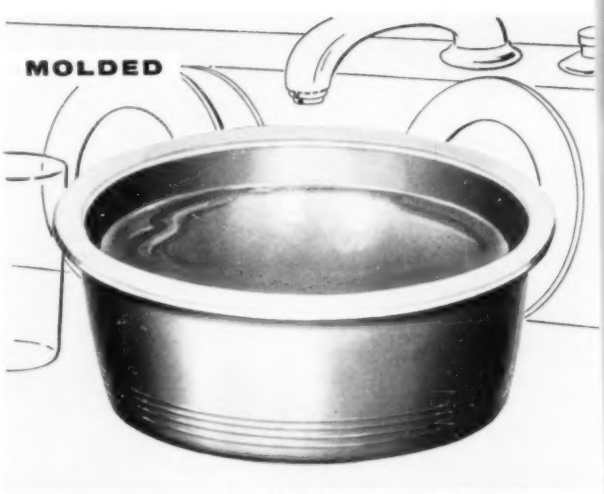


CHAMPAGNE BOTTLE STOPPERS eliminate problems of leakers as well as breaking corks, simplify bottling process and storage. They can be re-used on opened champagne bottles. "Sparkle-Top" stoppers molded of odorless, tasteless and non-toxic ALATHON 20, are unaffected by bottle's contents. (Distributed by Robert Shaffer Corp., Forest Hills 75, N. Y.)

Have a reason for your resin . . .

There's a

IDENTIFICATION BRACELETS for hospital use are inexpensively mass-produced from ALATHON 14. Clarity of ALATHON enables easy reading of information on strip insert. Strong, self-sealing bracelets will not pull loose. (Manufactured by Precision Dynamics Corporation, Burbank, Calif., for American Hospital Supply Corporation, in Evanston, Ill.)



MULTI-PURPOSE DISHPAN molded of ALATHON 17 is sturdy, yet soft and clatterproof . . . will not mar sinks, floors or furniture. Unaffected by food acids or cleaning bleaches, the seamless, rust-proof pan serves a variety of indoor and outdoor needs. (Manufactured by Como Plastics, Inc., Columbus, Indiana.)

DISPOSABLE SLIPPERS made of kraft paper coated with ALATHON 16 will not deteriorate, even when worn in the shower, under the hottest water. The elimination of the sewn method—suitable for cloth, but never intended for paper—is made possible by the excellent heat-sealing characteristics of ALATHON. (Coated by St. Regis Paper Co., New York City, for Gilbert Mfg. Co., Hialeah, Florida.)

CRIB 'N CARRIAGE TOY has flexible strap of ALATHON 10 which stands up under the stress and strain of baby's use. Readily formed in thin sections such as this, ALATHON is light in weight and can be easily colored. (Extruded by Polyform Plastics Corporation, for Alan-Jay Plastics, Inc., New York, New York.)

Du Pont ALATHON® polyethylene resin

tailored for your needs

Shown here are a few examples of how the family of Du Pont ALATHON polyethylene resins is being successfully applied to a variety of products.

In each of the many members of this versatile family, the molecular structure has been carefully controlled to develop a resin which excels in certain properties. Thus, there is an ALATHON tailored to give the best possible results . . . whether your product is extruded, molded or coated.

Fill in and mail the coupon for additional information and assistance in selecting the proper ALATHON polyethylene resin for your needs.

POLYCHEMICALS DEPARTMENT

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept.
Room 2710, Du Pont Building, Wilmington 98, Delaware

Please send me more information on Du Pont ALATHON polyethylene resins. I am interested in evaluating these materials for_____

Name_____

Company_____ Position_____

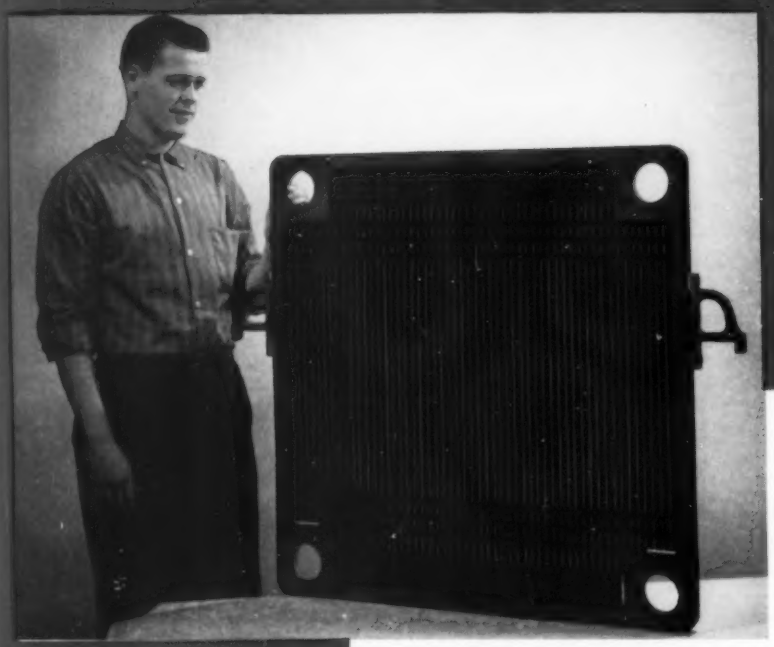
Street_____

City_____ State_____

Type of Business_____

In Canada: Du Pont Company of Canada (1956) Limited, P. O. Box 660, Montreal, Quebec.

Design CORROSION-RESISTANT PARTS for Lighter weight



...with ATLAC Thermaflow reinforced polyester molding compounds

This 36" plate for a chemical filter would weigh 260 pounds if made from stainless steel or resin coated cast iron. Instead, it weighs *only 75 pounds* . . . costs only one-third as much as stainless steel . . . yet withstands high pressures and exposure to acids and alkalis.

This new performance is being obtained by making the plates of ATLAC THERMAFLOW 100, a reinforced polyester molding compound. The plates go into filters made by T. Shriver & Co., Inc.

A principal reason for the excellent chemical resistance of this material is that it contains ATLAC 382, a different kind of polyester developed by Atlas, which has superior ability to resist attack by many chemicals. Other ATLAC THERMAFLOW compounds are excellent for structural and electrical designs, because of their high impact strength, arc resistance, high heat distortion temperature and flame resistance.

We make a wide range of glass fiber and nylon rag reinforced grades.

easy to mold

ATLAC THERMAFLOW materials mold easily in large shapes, deep draws, complex details. No weak spots at edges or corners . . . reinforcement flows uniformly throughout. They mold quickly on standard transfer or compression presses at moderate temperatures and pressures.

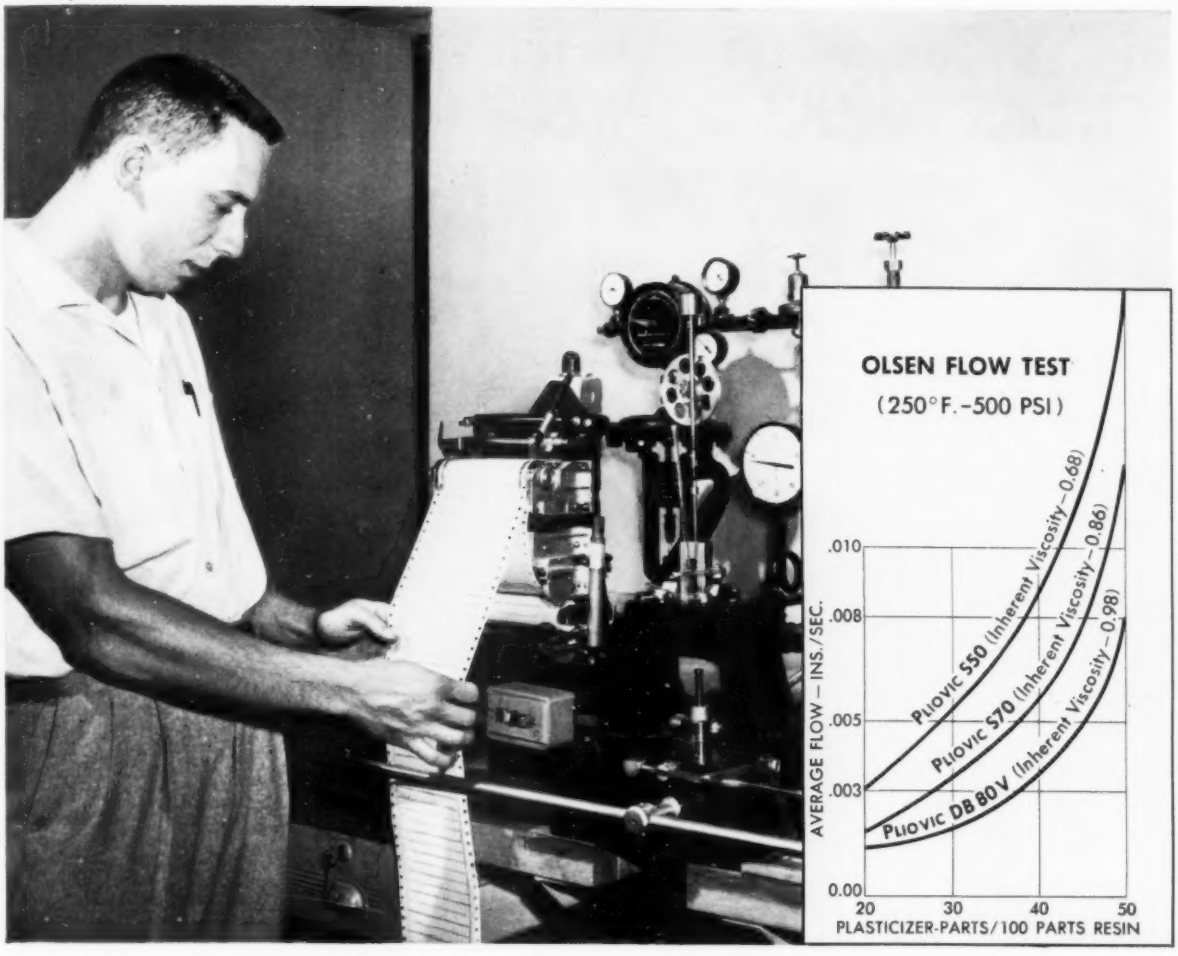
•

Write today for your copy of our new catalog.

ATLAC THERMAFLOW

ATLAS

ATLAS POWDER COMPANY
Chemicals Division
Wilmington 99, Delaware



Unique from the word—FLOW

That's the new PLIOVIC S50: Completely unique in its superior plastic flow properties. (See chart above.) It's a new kind of unmodified polyvinyl chloride resin of very low viscosity characteristics.

As a result of this lower viscosity, PLIOVIC S50 offers these processing advantages: 1. Excellent processability at temperatures as much as 50°F. *lower* than conventional PVC resins. 2. Easy processing without plasticizers. 3. More faithful reproductions in intricate dies and molds. At the same time PLIOVIC S50 maintains other properties consistent with those of unmodified vinyls.

There are a number of possible uses for PLIOVIC S50. Among these is the replacement of copolymer resins in molded, extruded or calendered goods where excellent flow plus excellent physical properties are needed. It can also be used in blends to improve the processability of higher molecular weight resins.

If you want to benefit from the word "flow," why not write for full details, including the latest *Tech Book Bulletins*, on PLIOVIC S50. Address: Goodyear, Chemical Division, Akron 16, Ohio.

CHEMICAL
GOODYEAR
DIVISION

PLASTICS
DEPARTMENT

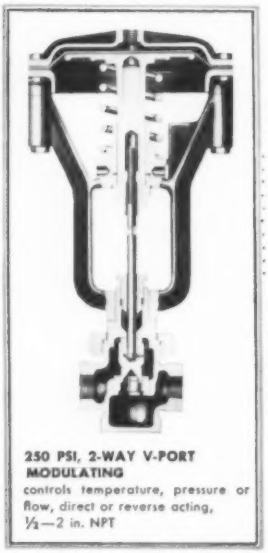
Chemigum, Plioflex, Pliolite, Pliovic –T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIOVIC • WING-CHEMICALS

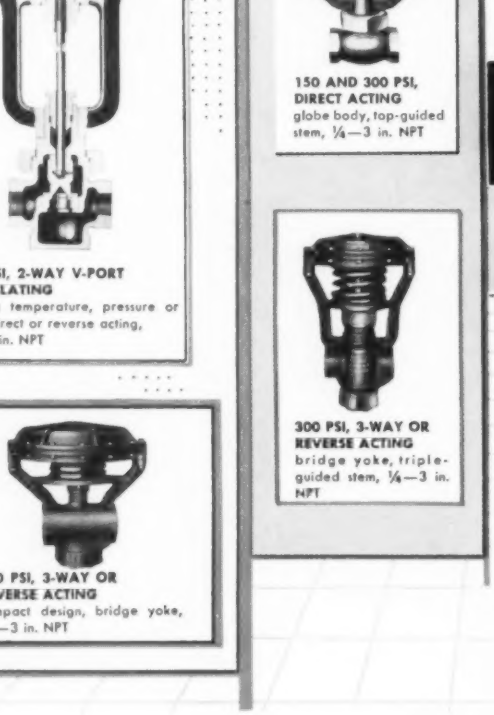
High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

Solve your fluid control problems with...

SINCLAIR-COLLINS DIAPHRAGM-OPERATED VALVES



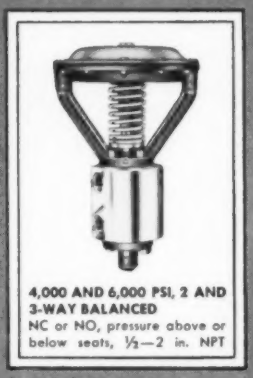
250 PSI, 2-WAY V-PORT MODULATING
controls temperature, pressure or flow, direct or reverse acting, ½—2 in. NPT



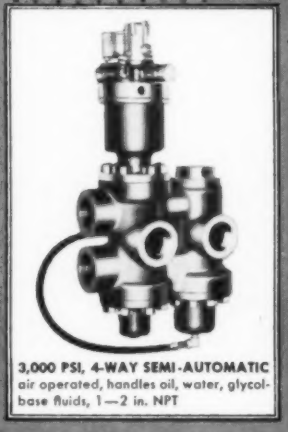
150 AND 300 PSI, DIRECT ACTING
globe body, top-guided stem, ¼—3 in. NPT

300 PSI, 3-WAY OR REVERSE ACTING
bridge yoke, triple-guided stem, ¼—3 in. NPT

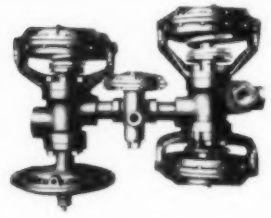
150 PSI, 3-WAY OR REVERSE ACTING
compact design, bridge yoke, ¼—3 in. NPT



4,000 AND 6,000 PSI, 2 AND 3-WAY BALANCED
NC or NO, pressure above or below seats, ½—2 in. NPT



3,000 PSI, 4-WAY SEMI-AUTOMATIC
air operated, handles oil, water, glycol-base fluids, 1—2 in. NPT



4,000 PSI, 3-WAY AUTOMATIC
2-pressure, auto-neutral, throttling, ½—3 in. NPT

FOR OIL, AIR, STEAM, HOT OR COLD RAW WATER SERVICE
2, 3, AND 4-WAY • SINGLE OR TWO PRESSURE
HIGH OR LOW PRESSURE—AIR OPERATED, OIL OPERATED
AUTOMATED OR REMOTE MANUAL CONTROL
IDEAL FOR CENTRAL RAW WATER HYDRAULIC SYSTEMS

Chances are, you'll find the answer to your control valve problems in Sinclair-Collins' line. Sound design and highest quality construction . . . Stellite stem seats, Monel stems, hardened replaceable body seats, heavy-duty bronze, ductile iron or cast steel bodies . . . these and many other features assure leak-free performance . . . resistance to corrosion . . . elimination of seat wire drawing . . . longest service life.

For recommendations, literature and fast delivery from stock, of dependable S-C valves that meet your needs *exactly*, call your nearby Sinclair-Collins representative or The Sinclair-Collins Valve Company, 454 Morgan Avenue, Akron 11, Ohio.

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Representatives in principal cities

THE SINCLAIR-COLLINS VALVE COMPANY

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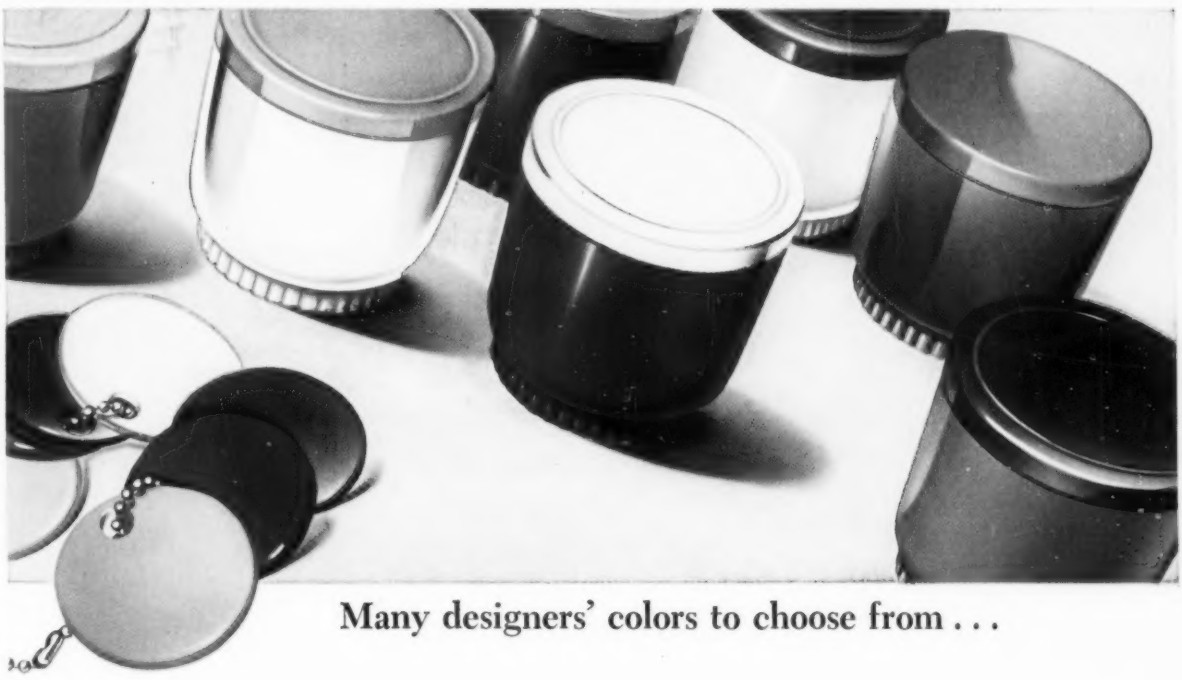
Convenient screw closure . . .
seals tightly, opens easily

Tip-proof design . . .
jars stack quickly, securely



Many designers' colors to choose from . . .

New Plastic Jar by Owens-Illinois

. . . has all the makings of a top-priced package!

HERE in O-I's new 4½-ounce Plastic Jar you have all the advantages your salespackage needs—color and eye-appeal . . . shelf advantages retailers like . . . user conveniences customers look for. It's a package you'd expect would be priced far higher!

Smartly designed—Plastic Jars stack easily, securely. Their screw closures seal tightly, open easily. And as for color or an eye-catching color combination—you can almost name it! For, in addition to clear plastic, jars are available in a wide variety of opaque and transparent colors. (Also available with domed-top cap.)

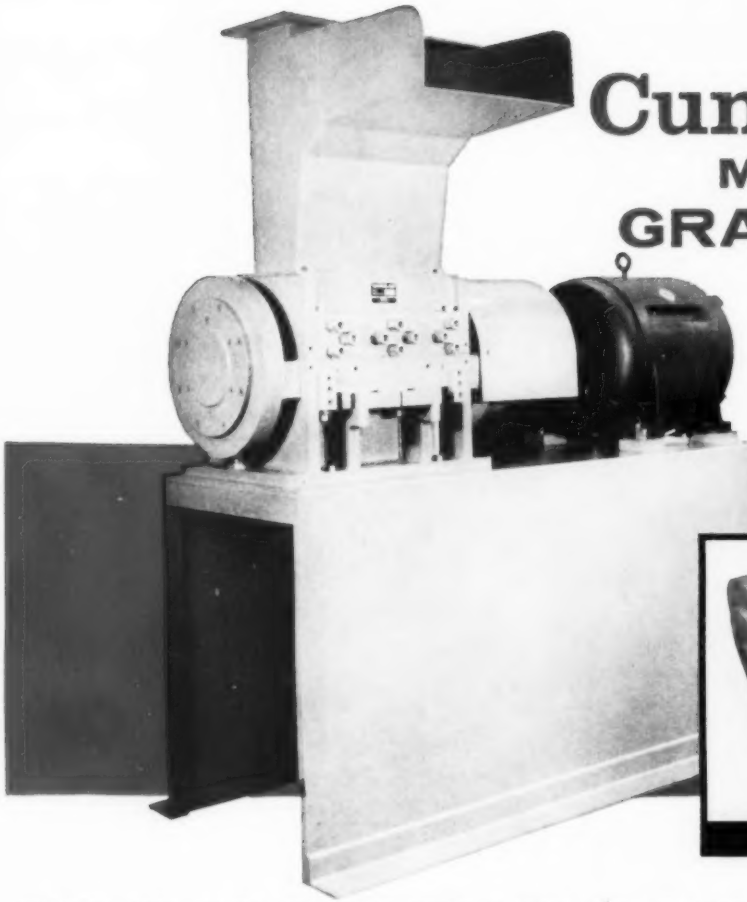
* * *

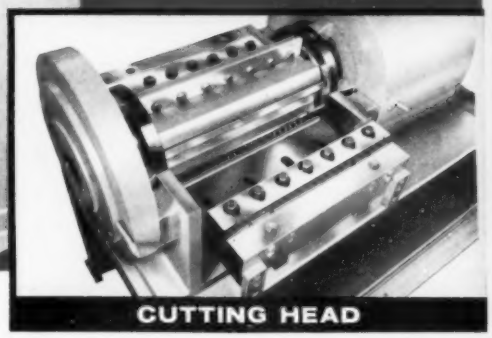
Find out more about O-I's new Plastic Jar. Your Owens-Illinois representative will be glad to show you samples. Telephone him, today!

OWENS-ILLINOIS PLASTICS
AN (I) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

Cumberland
MODEL 20
GRANULATOR





CUTTING HEAD

PART OF THE COMPLETE LINE OF CUMBERLAND PELLETIZERS, BESIDE THE PRESS AND CENTRAL GRANULATING MACHINES, DICERS, CHOPPERS AND PRE-BREAKERS

LARGE THROAT OPENINGS – 9" x 20"
– 12¾" x 20"

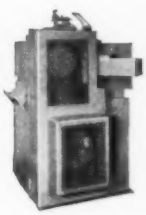
SUPERB CONSTRUCTION – heavy steel weldments with deep welds. Rotor and seal rings are heat treated to provide tough undamageable parts, and ground all over to achieve extreme dimensional accuracy and balance.

VERSATILITY – handles chunky parts of toughest plastic materials such as bleeder scrap, cylinder purgings and heavy slabs of thermoplastic materials. Special adaptors for handling long lengths of pipe such as kralastic, high impact vinyl and polyethylene.

Watch future ads featuring other outstanding Cumberland machines and write for Bulletin 260

STAIR STEP DICER

Perfect cubes or pellets 1/16" to 1". Two standard sizes accommodate up to 7" and up to 14" ribbons.



BESIDE THE PRESS GRANULATOR

Two new models. Throat sizes available:
8½" x 12"
12" x 16"
10" x 10"
6" x 10"
6½" x 8"

Cumberland
ENGINEERING COMPANY, INC.

317-7

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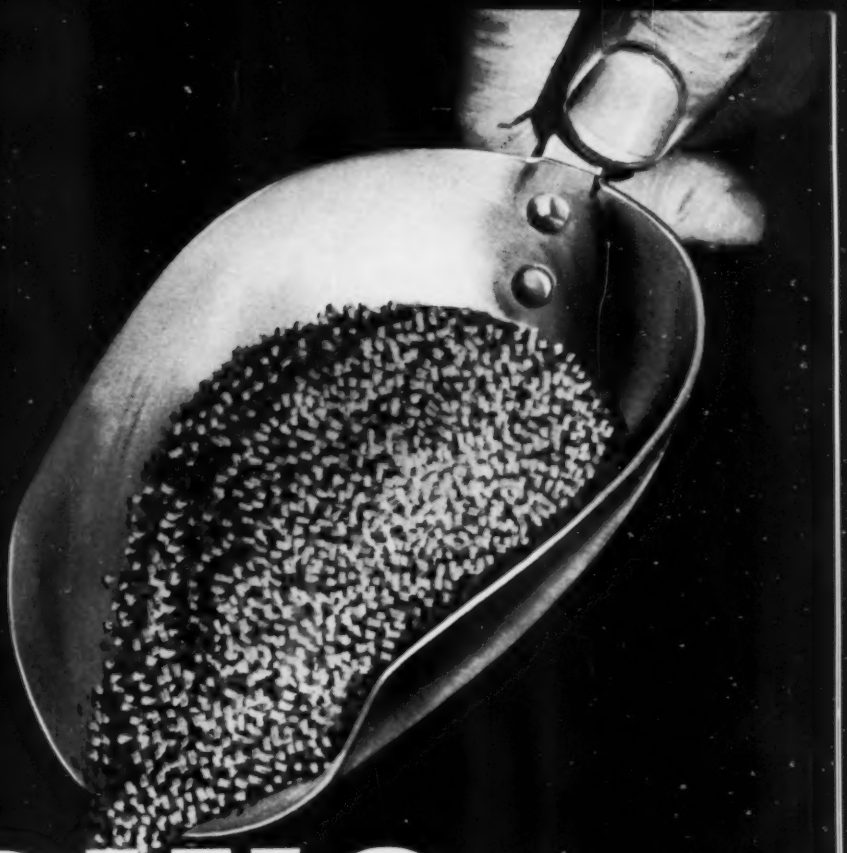
California Representative: West Coast Plastics Distributors, Inc.
8510 Warner Drive, Culver City, Calif.
FOREIGN LICENSEE – **Burtonwood Engineering Company, Ltd., Burtonwood, Warrington, Lancashire, England—Sole Manufacturers and Distributors outside North and South America.**



- *quality*
- *service*
- *dependability*
- *savings*

GERING

MOLDING COMPOUNDS

- **VIRGIN MOLDING COMPOUNDS**—Vinyl, Polyethylene, Acetate, Polystyrene, Impact Styrene
  —**"COLOR COMPOUNDING SPECIALISTS"**—Your orders formulated to exact color, flow and physical properties specifications.
- **REPROCESSED MOLDING COMPOUNDS**—Polyethylene, Vinyl, Polystyrene, Acetate, Nylon, Acrylics, Impact Styrene, Butyrate
  —**"CUT COSTS WITHOUT SACRIFICING QUALITY"**—Supplied in uniform, dust-free pellets . . . perfectly matched from first bag to last.
- **RIGID QUALITY CONTROL • COMPETITIVELY PRICED • SPEEDY DELIVERY**—no matter how large your order! Write Us About Your Specific Needs Today!

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Acetate Sheeting...

the perfect plastic material for blister packaging. JODA extruded acetate sheets, rolls and film in light to heavy gauges—transparent, translucent or opaque—is excellent for vacuum forming. The blister packaging shown here has helped double sales for the Woodhill Chemical Mfg. Co., Cleveland, Ohio. Woodhill's use of JODA crystal clear acetate for packaging its line of products is proof that modern transparent packaging increases sales!

For information and samples, contact

JOSEPH DAVIS PLASTICS CO.

430 Schuyler Ave.,
Kearny, N. J.

Phone WYman 1-0980-0981
N. Y. BArclay 7-6421-6422

Sales Representatives
Conveniently Located

Cable — Insel

"The new look in BRECK shampoo packaging! Beautiful, lightweight, unbreakable, plastic jars, molded from

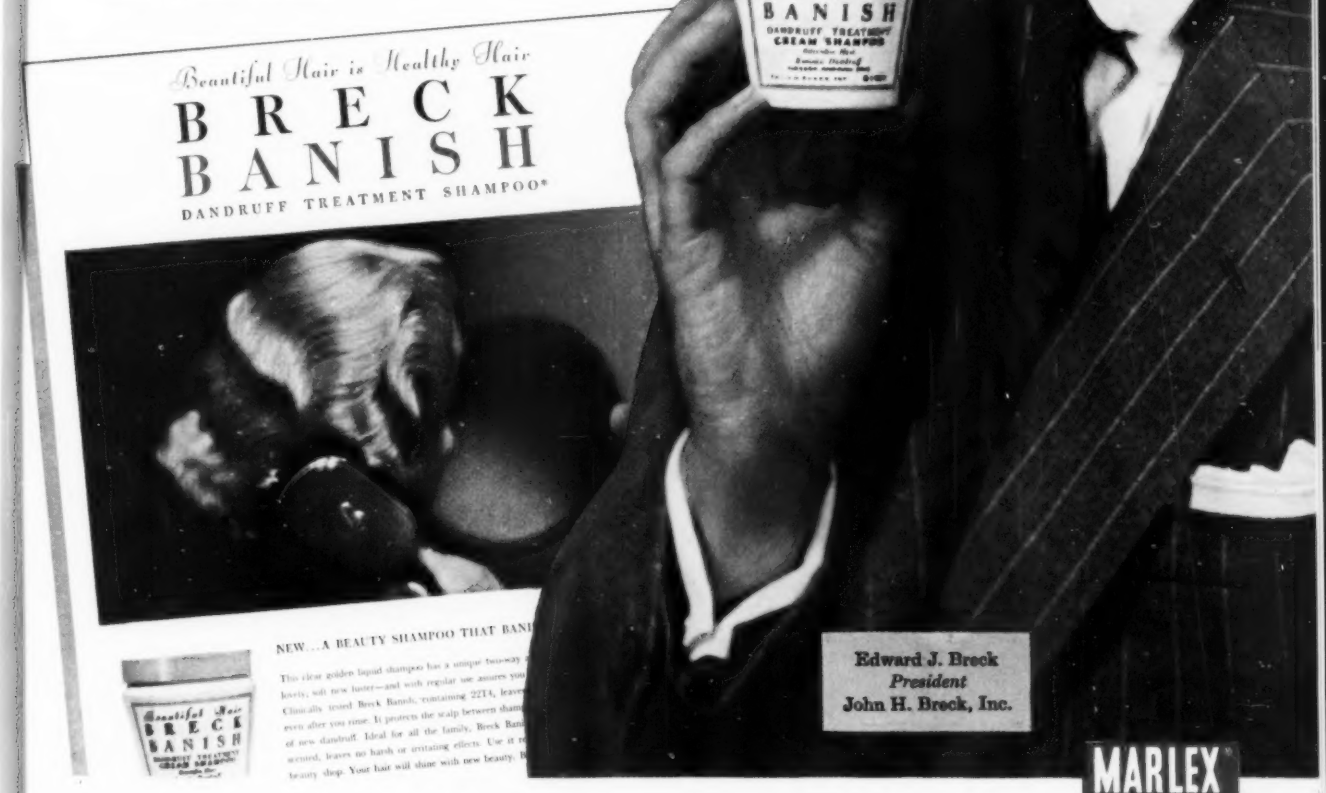
MARLEX*"

Designed and blow-molded by PLAX, this attractive 6-oz. widemouth contour jar has strong, thin walls that are shatterproof and chip-proof . . . safe in the bathroom . . . perfect for travel. The new tapered contour design is easy to hold, and the surface is gentle to the touch.

In addition to being first in the cosmetics field with this revolutionary new package, Breck saves more than 5 pounds per case in shipping weight, since the new jar has 1/10th the weight of a comparable opal glass jar!

This is just one of the many profitable new packaging possibilities with MARLEX . . . others include transparent film, squeeze bottles and tubes. No other type of packaging material is so versatile and economical.

*MARLEX is a trademark for Phillips family of olefin polymers.



Edward J. Breck
President
John H. Breck, Inc.

MARLEX

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma
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PLASTICS SALES OFFICES

NEW ENGLAND	NEW YORK and EXPORT	AKRON	CHICAGO	WESTERN	SOUTHERN
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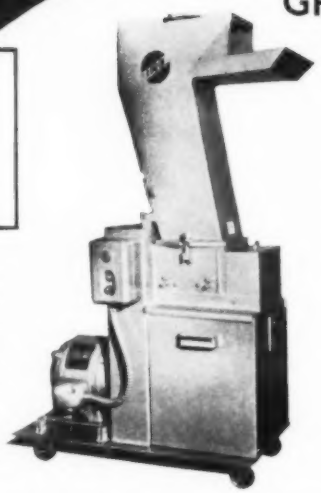
INJECTION MOLDERS!

BOOST PRODUCTION!

M-3 IMS M-4 GRANULATORS

All machines illustrated here in stock for

IMMEDIATE DELIVERY



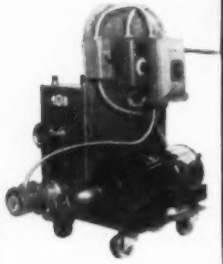
The IMS M-3 6½" x 7" throat sprue grinder — rugged — simple in design — easiest to clean — built-in throat clearance bar — casters — catch pan.

PRICE: Complete with 1 HP Motor and Starter ... $598.50
Same, but with 2 HP Motor $645.00

The IMS M-4 5⅜" x 8½" throat grinder — designed primarily for vinyl, polyethylene, plastisols and all elastomerics where a fine-free low bulk factor product is desired — large throat for large injection molded parts.

PRICE: Complete with 2 HP Motor and Starter $788.50
Same, but with 3 HP Motor $854.00

CONSTANT MOLD TEMPERATURE REGULATOR



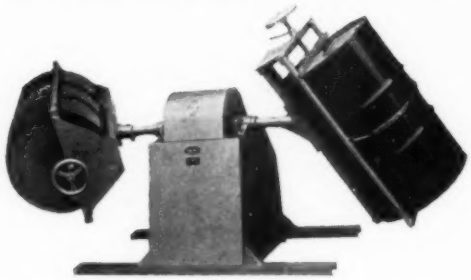
The IMS Economy Circulator — **priced at only $369.50 complete (oil model for heats to 450° at $482.50)** — duplicates performance of mold heaters costing up to 6 times as much — developed by a molder for molders — compact — portable only 15½" x 22" floor space.

Send for our New Nozzle Catalog and Heater Band Book Today. You'll find all styles of nozzles and heater bands fully described and priced, with technical notes on nylon molding.

Prompt service on all kinds of nozzles by the world's largest and most experienced nozzle and heating cylinder specialists.

IMS DRUM TUMBLERS

FOR ALL COLORING AND MIXING OPERATIONS



All IMS Drum Tumblers are based on design suggestions of the leading material and colorant suppliers.

Available for immediate shipment from stock.

¾ HP Model **$595.00**
(Takes drums up to 33" high x 22" in diam.)

2 HP Model **$897.50**
(Takes drums up to 37" high x 23¼" in diam.)

3 HP Model **$1285.00**
(Takes drums up to 45" high x 24" in diam.)

INJECTION MOLDERS SUPPLY CO.

3514 LEE ROAD, WYoming 1-1424
CLEVELAND 20, OHIO

a 100% H-P-M Plant

Six of Fibro's ten H-P-Ms showing two new 20 oz. machines.

One of two H-P-M 6 oz. machines molding closures—fully automatic.

Screw driver handles being molded on an H-P-M 20 oz. Fibro is one of the largest molders of this item in the world.

FIBRO CORPORATION Has Averaged a New H-P-M Every Year for the Past Ten Years

Now one of the most modern custom molding plants in the country, THE FIBRO CORPORATION, Clark, New Jersey, began operations 10 years ago with one H-P-M 9 oz. machine. Today, they have 10 H-P-Ms in use—ranging in size from 6 oz. automatics to the 48 oz. preplasticizers.

To keep brand loyalty such as this, these H-P-Ms just had to be better—in every way for ten years. In fact, John Fontenelli, general manager of FIBRO, says, "We buy H-P-Ms because of their ability to provide capacities over and above their normal rating. Then, too, they are built to withstand our 24 hours a day, seven days a week production schedule."

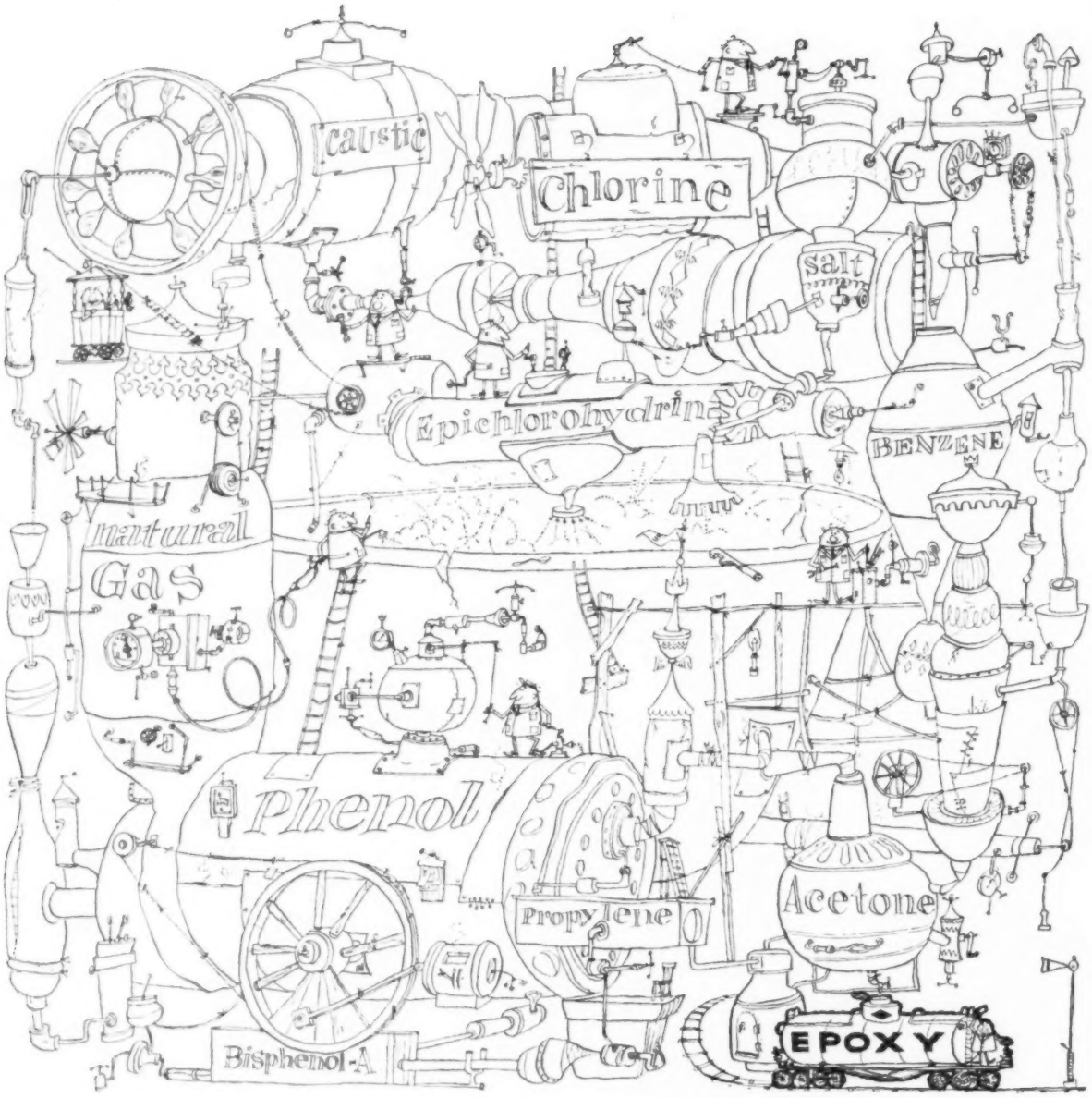
Write today for information on the versatile H-P-Ms–machines designed to give you larger capacities–faster cycles–fewer rejects and bigger savings in production costs.

There's a machine for every molding requirement.

H848

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.



Dow's basic position in epoxy production assures purity, narrower "spec" range

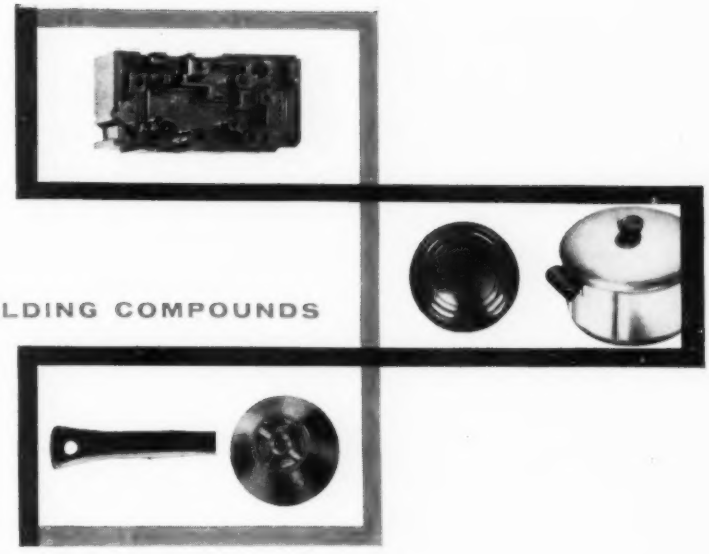
New Dow Epoxy Resins provide outstanding purity because no other company makes so many (more than 93%) of the raw materials that go into them. And the one sure way to control purity of epoxy resins is to make the raw materials in your own plant, under your own supervision.

Purity is only one benefit enjoyed by users of Dow epoxies. Others are: better quality control, narrower range of specifications, an assured source of supply, and versatility of raw materials. The exclusive control of ingredients has resulted in new and improved epoxies such as D.E.R. 332 (new water-clear liquid resin) and Dow's new line of water-white solid epoxy resins.

With years of experience in producing epoxy raw materials, Dow can assure you Dow Epoxy Resins will best meet your highest specification standards. For information or copies of this cartoon contact your Dow sales office. Or write: THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Department 2260H-1.

EPOXY T.M.

YOU CAN DEPEND ON DOW®



A GOOD WORD FOR

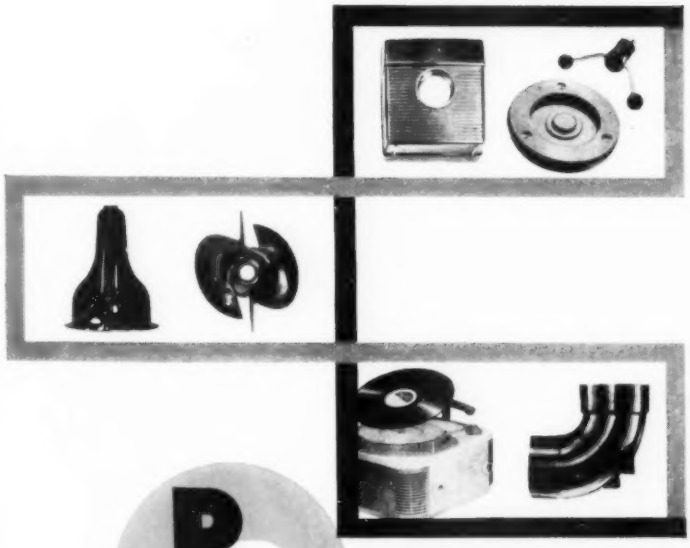
QUALITY PHENOLIC MOLDING COMPOUNDS

IN THEIR

WIDEST APPLICATION

IS

PLENCO



. . . a good word, too, for dependable counsel. Whether you take our advice or not, you can't help but profit from your consultation with Plenco's problem-solving specialists. And, in production, you can't help but benefit from the wide-ranging knowledge with which these modern molding materials are formulated and the precision with which they are produced.

Does phenolics have the answer for you? Then, chances are that Plenco compounds, in their exceptional variety, versatility and quality-controlled uniformity, can provide it. We invite you to let us demonstrate that.

PLENCO PHENOLICS

FOR BETTER PLASTIC PRODUCTS

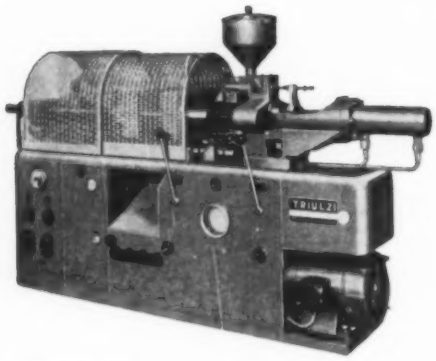
PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

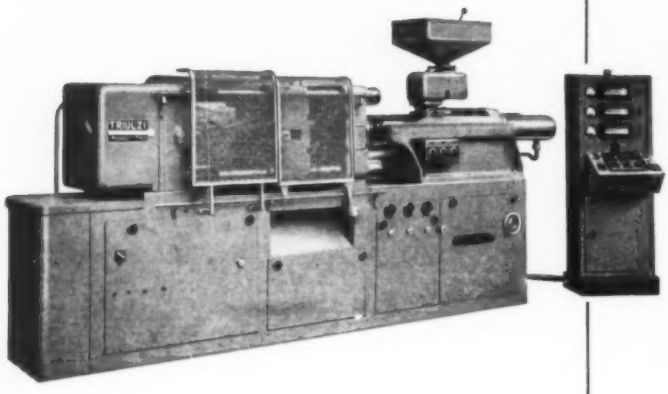
Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

Plastmatic TRIULZI machines

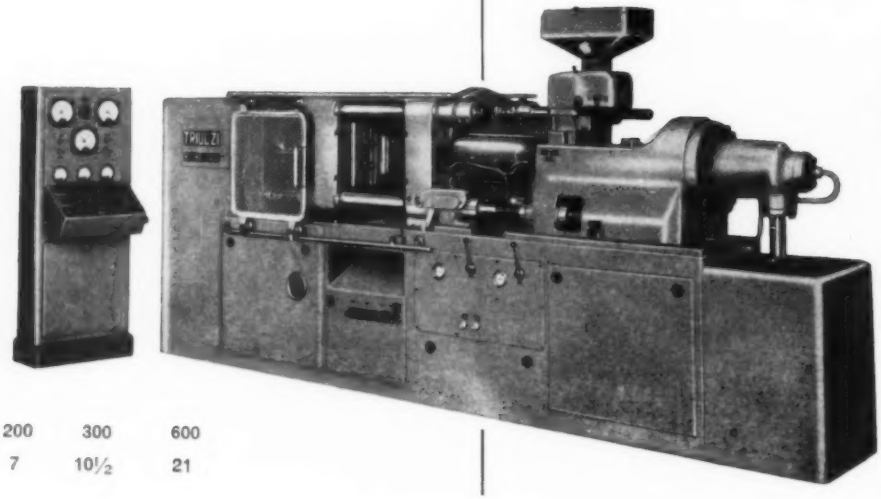
TRIULZI Injection Molding Machine capacities range from 4 to 10,000 grams (350 oz.)



Model 30: 1 oz.



Model	50	90	140
Oz.	1¾	3¼	5



Model	200	300	600
Oz.	7	10½	21

Fully automatic

Fast cycling

Self-contained

Easy to operate

Ruggedly constructed

Safer

Simple to maintain

. . . . and Interestingly priced!

For details and literature write

Off. **A. TRIULZI** s.a.s.

via Vialba 56 NOVATE (Milano), Italy

Telegrams: TRIULZIPRES—NOVATE MILANESE

IMPACT-RESISTING PVC RIGIDS

Boost their toughness, weather resistance with "Dutch Boy" basic lead stabilization

Ease production, cut stabilization cost, too!

Much is expected of impact-resisting PVC rigids... sheet, pipe, structurals. And "Dutch Boy" *basic lead* stabilization is the economical way to meet customer's expectations.

With "Dutch Boy" *basic lead* stabilization, rigids are measurably stronger, measurably tougher. Impact and rupture strengths, moduli of elasticity all go up.

Weather resistance, too, goes up. That's because "Dutch Boy" *basic lead* stabilizers are efficient... stay on the job through severe heat of processing rigid stock. Exposure tests prove finished products have optimum ultra-violet light and oxidation resistance.

For quality, for economy . . . use "Dutch Boy" DYPHOS® and DS-207®

"Dutch Boy" *Dyphos* and *DS-207* stabilizers give you *basic lead* stabilization at its best...plus two-way economy.

First, among stabilizers suitable for high impact rigids, these Dutch Boy stabilizers cost the least to buy... less than half as much. Second, both greatly ease processing.

With "Dutch Boy" *Dyphos* stabilizer, control of process conditions is less critical, color problems reduced. It seizes acid breakdown products, blocks the oxidation caused by working non-plasticized mass at high heat. "Dutch Boy" *DS-207* stabilizer provides continuous, single-phase lubrication, evenly distributed. No melting!

Improve the stabilization of your impact-resisting PVC rigids the "Dutch Boy" way. If you need technical assistance just say the word.

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY, 111 Broadway, New York 6, N.Y.

In Canada: CANADIAN TITANIUM PIGMENTS LIMITED, 630 Dorchester Street, West • Montreal.

time to switch to pro-fax

Hercules polypropylene

Switch to Pro-fax, the versatile new plastic with a combination of properties never before available in a single material, and watch your profits grow.

Lightest of all plastics, Pro-fax provides an extra unit yield per pound that can spell significant cost savings.

Heat resistant up to 300°F., parts made with Pro-fax can withstand steam sterilization, now make it possible to use this new thermoplastic in the place of other more costly materials.

Chemically inert, Pro-fax resists solvents, greases, oils, most common chemicals and acids, and is immune to environmental stress cracking.

Combined with all these functional advantages unique in this new thermoplastic, Pro-fax has strength, rigidity, good surface hardness and excellent color and finish in a low-cost plastic that lends itself to low-cost production by a variety of processing methods.

Complete data on product and mold design available on request. Call or write:

Cellulose Products Department

HERCULES POWDER COMPANY
INCORPORATED

900 Market Street, Wilmington 99, Delaware

THREE NEW MATERIALS FOR THE PLASTICS INDUSTRY

Hi-fax® High-density polyethylene • Pro-fax® Polypropylene • Penton® Chlorinated polyether

a PACKAGING FILMS based on Pro-fax have excellent tear and tensile strength; are heat sealable and have good printability.

b ECONOMICAL TO MOLD, these Pro-fax electrical connectors have high heat resistance.

c TOUGHNESS & RIGIDITY in a chemically inert material make Pro-fax ideal for pipe fittings.

d STYLING and functional advantages are combined in Pro-fax closures for hard-to-package products.

e COMPLEX SHAPES held to close tolerances can be readily molded in Pro-fax.

f HAIR ORNAMENTS illustrate the resilience, rigidity, and lightweight toughness of Pro-fax.

g CHEMICALLY INERT, Pro-fax can be used in many fields previously served by metal.

h HEAT STABLE at 300°F., hospital utensils made with Pro-fax can be steam-autoclaved.

SEE US AT BOOTH NO. 436

8TH NATIONAL

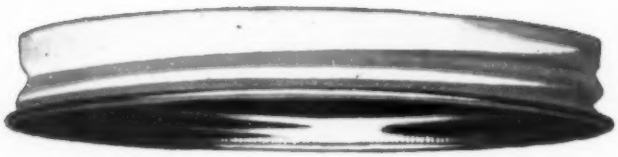
PLASTICS

EXPOSITION

NOV. 17-21

INT'L AMPHITHEATRE – CHICAGO

CP58-8



What's up in closures?

Plastisol Cap Liners made with Low Cost

CITROFLEX A-4 *Plasticizer are Nontoxic... Odor-Free!*

● A good jar can do its job *only* if the lid offers the same protection as the glass.

That means that the sealing ring and liner inside the lid must work efficiently and at the same time be odor-free... nontoxic... completely harmless to *both* fatty and non-fatty food contents.

Nothing meets these requirements better than vinyl plastisol liners made with safe, low-cost Citroflex® A-4 plasticizer.

Citroflex A-4 also finds excellent use in plasticizing vinyls for coating food containers and for producing food wrap films. Citroflex A-2, a companion product, is a nontoxic, odorless plasticizer for cellulose acetate food wraps for both fatty and non-fatty foods. Both Citroflex A-2 and A-4 are accepted by the Food and Drug Administration.

Your Pfizer representative will be glad to explain how Citroflex plasticizers can serve your needs.

Costs of these citric acid esters are remarkably low, compared to other nontoxic plasticizers. Besides A-2 and A-4, the Pfizer Citroflex line includes Citroflex 2 (Triethyl Citrate), Citroflex 4 (Tributyl Citrate) and Citroflex A-8 (Acetyl Tri-2-Ethylhexyl Citrate). Check into the Pfizer Citroflex plasticizers today.

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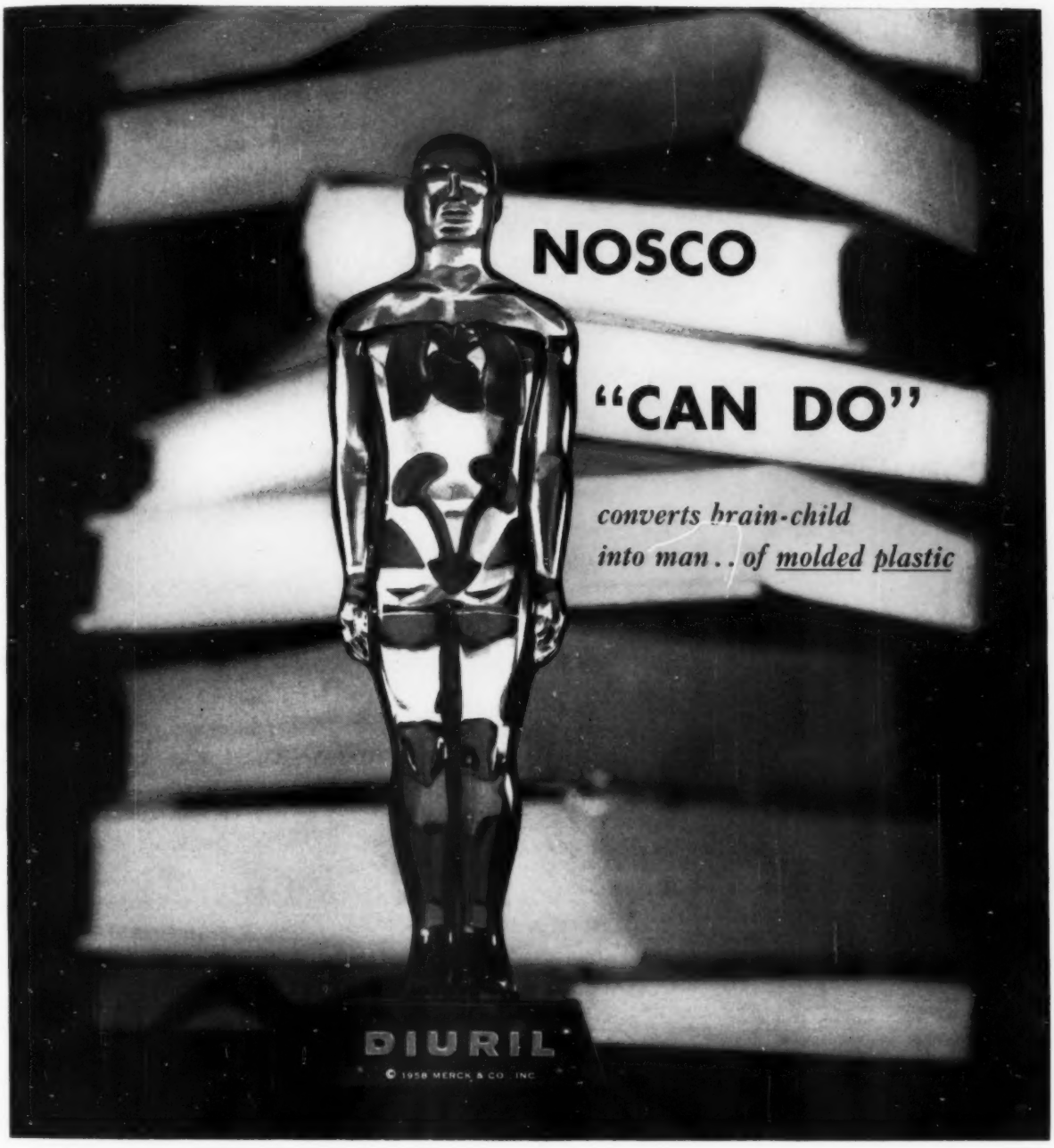
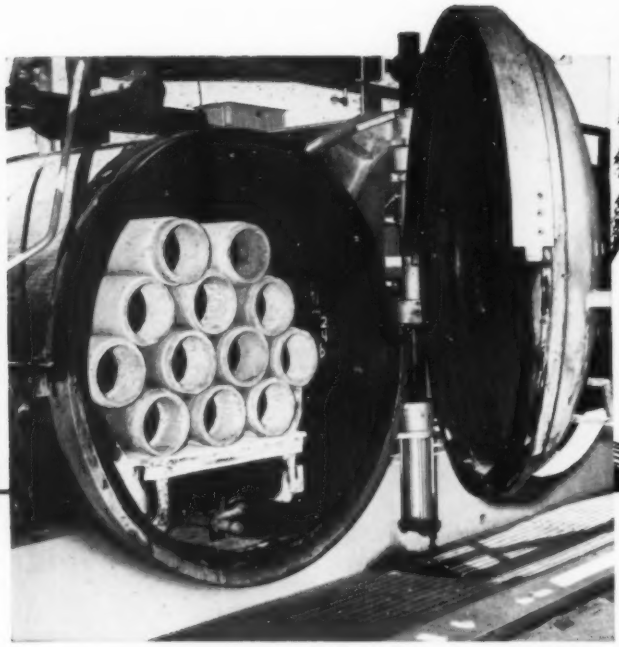


This was the brain-child of Merck Sharp & Dohme, pharmaceutical manufacturer. They showed Nosco a sketch and said "Make us a man, six inches tall: a small plastic figure to introduce doctors to 'DIURIL,' a new drug which controls the body's fluid content." The figure had to be fluid-filled and transparent to show the internal organs.

How did Nosco "Can Do" make a man? First we built a prototype by hand, then refined the design many times to facilitate volume production. The figurine is molded of cellulose propionate plastic in a Nosco-designed, two-unit mold. Each finished figure contains five parts. Nosco's finishing department painted the tiny heart, lungs and kidneys, hot-stamped the trade name, cemented the internal organs, assembled the front and back body sections, filled the figure with fluid to a pre-specified level, cemented the plug in place, packed both individual and shipping cartons . . . and we had our man! *Rate of assembly: 3000 per shift!*

The toughest part of Nosco's job was to prevent leakage. Here's how successful we were: Nosco quality control delivered over 99.9% non-leaking, *perfect* pieces. Nosco likes tough jobs . . . likes to turn *your* brain-child into reality in practical plastics. For more information about Nosco "Can Do," just write or call.

NOSCO plastics, inc. · erie 5, pa. *World's largest injection molding plant*

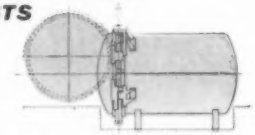


Memo to Production Engineers

◀ Adamson 90" dia. Hi-Lift Swing Door installed at Johns-Manville Products Corporation, Manville, N. J. One of many Adamson doors now in operation, or on order, for use in steam-curing TRANSITE® Pipe at J-M Plants in the U. S. and Canada.

Here are 6 important reasons why you should specify ADAMSON UNITED Hi-Lift Swing Vulcanizer & Autoclave Doors

1 LOWER INSTALLATION AND OPERATING COSTS



Adamson's lift-swing feature eliminates need for extended pit and expensive bridging. For example, on a 90" dia. door you can use an easily-handled loading bridge as short as 22".

2 TIGHT, LEAKPROOF SEAL

Adamson's special heat-resistant, self-sealing gasket utilizes vessel's internal pressure to assure a positive, leakproof seal.

3 EFFICIENT SLIDE-LOCK DESIGN

Provides virtually 360° of locking surface between door and mating shell ring. *Twice* the locking area of conventional breech-lock doors!

4 SAFE, RELIABLE OPERATION

Equipped with automatic door locking pins. Can be furnished with optional steam interlock controls for complete safety. Other built-in safety features included.

5 STRONGER CONSTRUCTION

Conventional castings are replaced by sturdy pressed steel head welded to continuous roll forged locking rings.

6 FAST OPENING AND CLOSING

Quick-unlocking, vertical-lift action powered by hydraulic cylinder. Door swings easily on anti-friction and bronze sleeve bearings. Simple, trouble-free operation.

7067

ADAMSON UNITED COMPANY

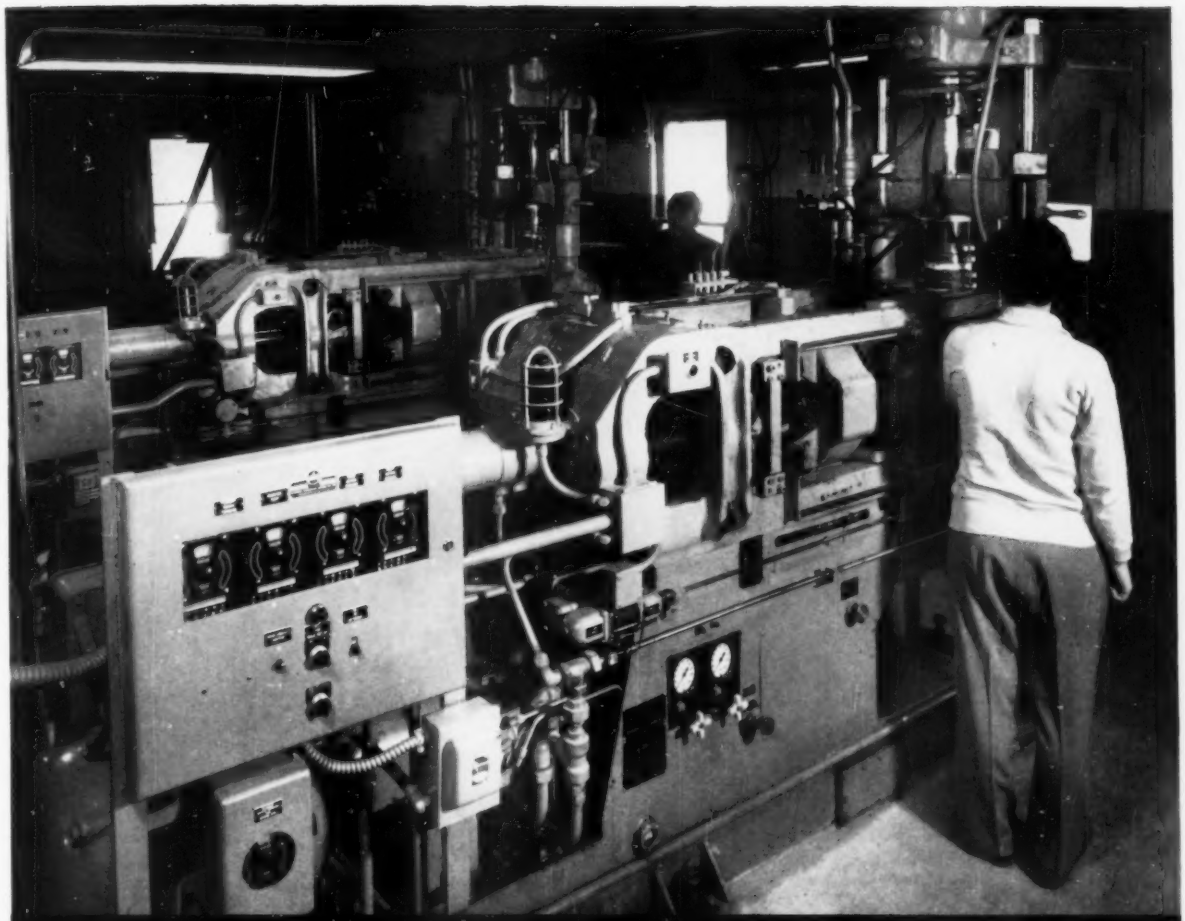
730 CARROLL STREET, AKRON 4, OHIO

Subsidiary of United Engineering and Foundry Company

Plants at Pittsburgh, Vandergrift, Wilmington, Youngstown, Canton

We offer a wide range of door sizes and pressures, available as integral equipment on vessels supplied by us, or as separate units for mounting on tanks made by other manufacturers. Write for catalog No. 562.

DESIGNERS AND BUILDERS OF BASIC MACHINERY AND EQUIPMENT FOR COMPLETE PROCESSES



5 oz. of VINYL from a 4 oz. LESTER

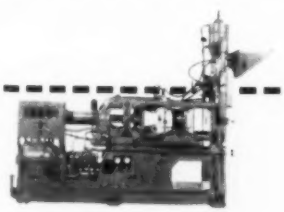
Despite the fact that vinyl is a "derating," heat-sensitive material, they're doing an exceptional job of molding it on a 4 oz. Lester at Draudt Engineering Company (soon to be incorporated under a new name) in Cleveland. The parts shown here are vacuum cleaner hose connectors, a Dreco proprietary item. The 4-cavity shot, including the sprue and runners, weighs a hair over 5 ounces.

Don Draudt, Gen. Mgr., says, "We could hardly believe our eyes when we tested this mold on the 4 oz. Lester – good parts right from the start!

Two important features of the Lester give it the margin of ability to do this job:

1. The unique Lester INTERNALLY HEATED vertical injection cylinder provides for ample plasticizing capacity.
2. The superbly rigid, one-piece cast alloy frame provides an unvaryingly dependable clamp – even for oversize shots. And remember the clamping tonnage rating of every Lester is certified by an independent consulting engineer.

If you're looking for dependable, trouble-free molding, check the performance of Lester machines – in 4, 8, 12, 20 and 60 ounce capacities.



LESTER-PHOENIX, INC.

2621-C CHURCH AVENUE • CLEVELAND 13, OHIO

Agents in principal cities throughout the world

In the sports deck lounge on the new Cunard liner, R.M.S. Sylvania, the 14 in. diameter ceiling lighting bowls and the lay-light panels are made of Opal 040 'Perspex'. The balustrade is decoratively engraved. Manufacturer: Maison Fittings, Liverpool. Designer: E. C. Leach, F.R.I.B.A.

CEILING light bowls and lay-light panels of Opal 040 'Perspex' which give a diffused lighting effect and balustrades made from ¼ in. thick clear 'Perspex' acrylic sheet do much to make the R.M.S. Sylvania the gay ship she is. 'Perspex' is an attractive material designed to stay attractive through years of service. It's tough, light and is not affected by atmospheric changes or sea air. 'Perspex' can be easily shaped and, as the balustrades in the illustration show, can be decoratively engraved.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Plastics Division, Export Dept., Black Fan Road, Welwyn Garden City, Herts.

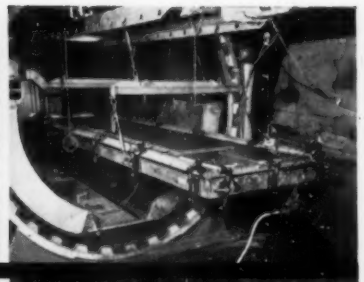
U.S.A. Enquiries to:
J. B. Henriques Inc., 521 Fifth Avenue, New York, N.Y.

Canadian Enquiries to:
Canadian Industries Ltd., Plastics Dept., Box 10, Montreal P.Q.

FP 60/O/A

FAIRCHILD

1) Reynolon MBA/4-3 Series PVA Film used in fabricating aircraft part. Shown is metal bonding lay-up with 26" hg vacuum. Note fine deformation around tooling. Reynolon can be formed into difficult contours without bridging.
2) Lay-up emerging from autoclave after reaching 480°F. temperature. Photos courtesy of Fairchild Aircraft Division of Fairchild Engine & Airplane Corporation.

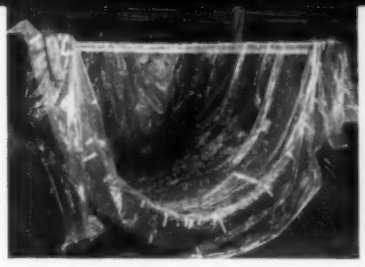


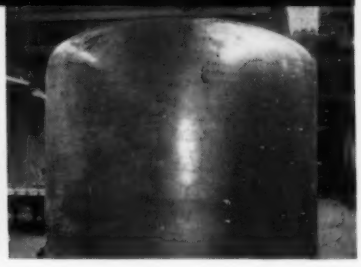
DOUGLAS

1) Reynolon PVA/4-6 Series Film used in vacuum bag molding of plastic hot air duct for transport plane. Operator can visually inspect the lay-up assuring quality controlled production of parts.
2) Vacuum bag molding nose wheel door for a Douglas jet bomber. Photos courtesy of Douglas Aircraft Company, Inc.

GOODYEAR

1) Reynolon PVA/4-6 Series Film used in fabricating radome section. Fiberglass saturated with plastic resin is layed-up inside female die and blanketed with PVA prior to pulling a vacuum and curing.
2) Completed radome section following cure and removal of PVA blanket. Photos courtesy of Goodyear Aircraft Division of Goodyear Tire and Rubber Company.





REYNOLON® PVA FILMS

for Bag Molding and Metal Bonding

...reduce costs, take to complex shapes, withstand high heat and pressures

Aircraft, boat, automotive and other manufacturers are using Reynolon Polyvinyl Alcohol Films for fast, low cost production of diversified parts.

Reynolon PVA/4-6 Series Film is designed for bag molding. Bag molding speeds production – is far less costly than the use of matched metal dies. And Reynolon – with its high elongation characteristics and non-inhibiting, clean operating qualities – is ideal for molding reinforced plastic parts.

Reynolon MBA/4-3 Series Film is a "super-pli" PVA film developed to improve adhesive metal bonding. Reynolon MBA film takes temperatures to 500°F. and pressures required to insure a satisfactory bond. It is extremely pliable and can be formed into difficult contours without bridging. An inexpensive sheet, instead of a costly rubber blanket, can be used to hold a lay-up in perfect alignment during the adhesive curing cycle in an autoclave.

For details and technical assistance on these films and other Reynolon plastic films, contact the Plastics Sales Manager in the Reynolds office in New York, Camden, Detroit, Chicago, St. Louis or Los Angeles. Or write Plastics Division, Reynolds Metals Company, Richmond 18, Virginia.

polyvinyl alcohol films for–

BAG MOLDING
METAL BONDING
SOLUBLE PACKAGING

polyvinyl chloride films for–

PACKAGING
INFLATABLES
OXYGEN TENTS
GLASS SUBSTITUTIONS
PROTECTIVE COVER PRODUCTS

PLASTICS DIVISION
REYNOLDS METALS COMPANY

ANOTHER NEW DE MATTIA

FOR FASTER CYCLING AND BETTER PRODUCTION

the DE MATTIA 12/16 OZ. MODEL M-1 INJECTION MOLDING MACHINE

12 CYCLES PER MINUTE
LOWER COSTS • TOP EFFICIENCY

PLASTICIZING CAPACITY	150 lbs./hr.
MAXIMUM DAYLIGHT	32"
CLAMPING PRESSURE	400 tons
MAXIMUM MOLD SIZE	20" x 30" horiz. 16" x 32" vert.

THE NEW DE MATTIA MODEL M-1 offers a new opportunity to increase and improve your production, raise your molding profits.

WRITE FOR COMPLETE SPECIFICATIONS

SEE US AT BOOTH 350

8th National Plastics Exposition

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Every bulk shipment of AIRCO vinyl acetate monomer must pass inspection by ultraviolet spectrophotometry. The entire absorbance curve of the sample must lie within the established boundary characteristic of highest purity monomer. This sensitive technique, which can detect trace amounts of impurities, is used in conjunction with numerous other analytical procedures as a routine part of AIRCO quality control.

When you specify AIRCO Vinyl Acetate Monomer you can always depend on high purity and the resulting consistent reaction characteristics that are so important to you in cost control and polymer performance.

Order your Vinyl Acetate Monomer from AIRCO. Available in tank car, tank truck and drum quantities. Remember also that when you need help in solving specific technical problems we're glad to lend a hand.

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HERE ARE FACTS ON HOW

WITH TODAY'S

TYPICAL PROPERTIES

High-Density Polyethylene

Melt Index, dgm/min	0.3–8.5*
Secant Modulus, at 1% elongation, psi	90,000–150,000*
Yield Strength, psi	3,100
Tensile Strength, psi	3,300
Tensile Impact, ft. lbs/in³	70
Elongation, per cent	50
Hardness, Durometer "D"	56
Dielectric Constant, 50MC	2.34
Dissipation Factor, 50MC	0.0002
Melting Temperature Range, deg. C	120–130

**Depending on specific product*

Q. Is high-density just "another" polyethylene?

A. With a density range from .942 to .965, BAKELITE Brand high-density polyethylenes are, in many respects, completely new materials. They offer improved rigidity and excellent dimensional stability at both high and low temperatures. Resistance to chemicals is greater and vapor and liquid permeability is reduced.

Q. Is it possible to obtain all densities from one polyethylene supplier?

A. Yes, with the addition of these high-density materials, the BAKELITE Brand polyethylene line now includes densities from .915 to .965.

Q. Can existing molding equipment be used?

A. Because BAKELITE high-density resins permit faster molding cycles, some modifications in runner, sprue and gating design may be required. Good principles of mold design should be followed. All other techniques need little or no change.

1033

YOU CAN SAVE

NEW BAKELITE BRAND High-Density Polyethylene

Q. What are the advantages of BAKELITE Brand high-density polyethylene for injection molding?

A. BAKELITE Brand high-density polyethylene compounds permit thinner sections without loss of rigidity or load-bearing characteristics and offer easier flow with higher melt index for multiple-cavity molding.

Q. What are the advantages for blow molding?

A. BAKELITE Brand DMDA-4901 is capable of withstanding sterilization temperatures of 250°F. at 15 psi. steam pressure. It provides stiffness 4 to 5 times that of low-density resins, reduced permeability, excellent printability.

Q. Can Bakelite Company provide a compound for specific needs?

A. There are presently nine BAKELITE Brand high-density polyethylene compounds incorporating properties that meet the over-all requirements of customers for molding, extrusion coating, film extrusion, monofilaments, contour extrusion and sheet extrusion for vacuum forming.

Q. What factors assure uniformity?

A. In new Bakelite Company plants for production of high-density polyethylenes, processes are fully automated for quality control. Newly developed blending equipment produces blends with batch-to-batch uniformity in box-car quantities. Over all, there is the 40-year experience of Bakelite Company in producing quality plastics.

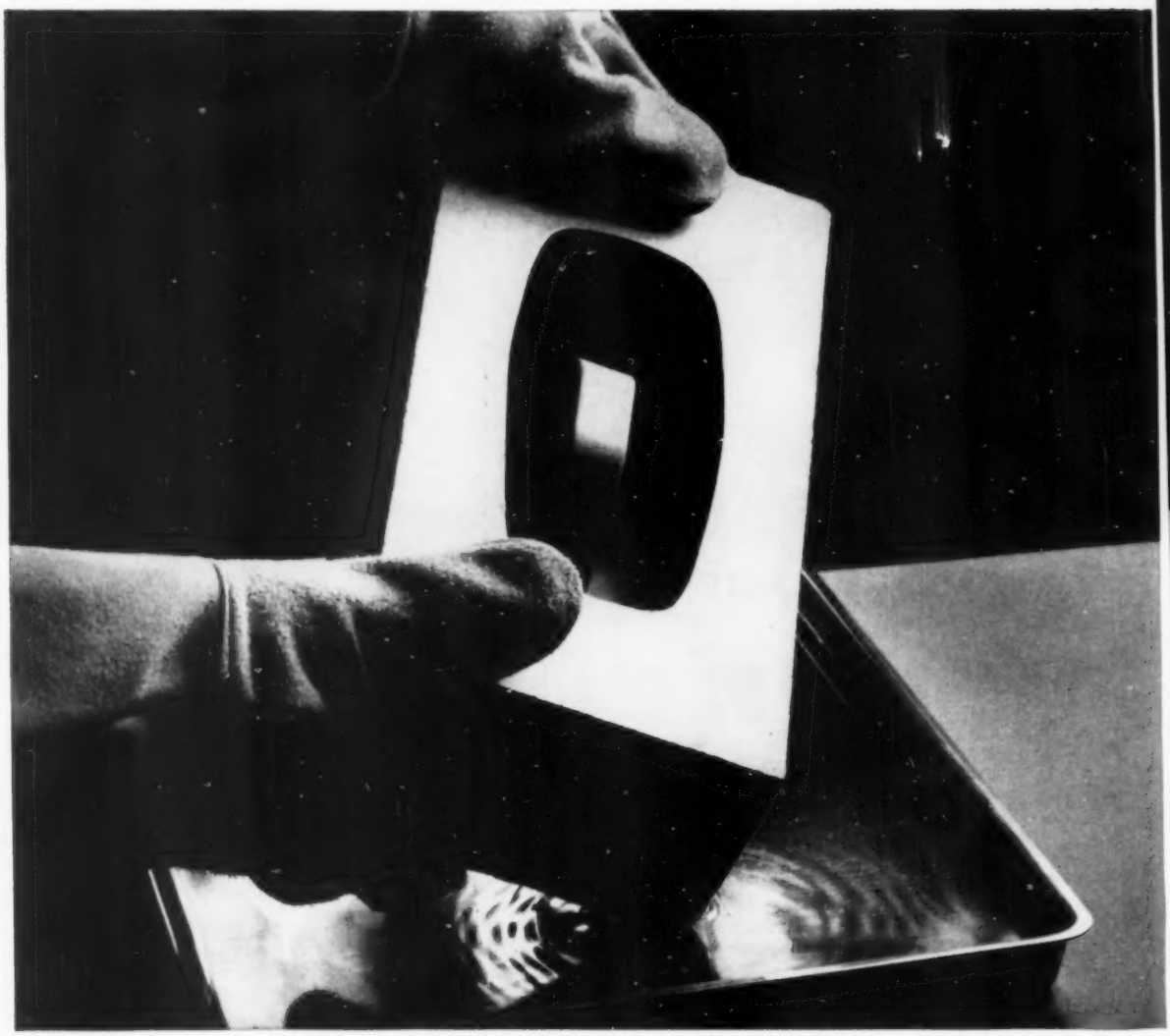
Q. Is additional technical data available?

A. Yes, in technical bulletins obtainable on request to your Bakelite Company Technical Representative, or by writing Dept. JC-33G.

Products of UNION CARBIDE *Corporation*

BAKELITE COMPANY, Division of UNION CARBIDE CORPORATION, 30 East 42nd Street, New York 17, N. Y.
In Canada: BAKELITE COMPANY, Division of Union Carbide Canada Limited, Toronto 7
The terms BAKELITE and UNION CARBIDE are registered trade-marks of UCC.

3M Chemicals opening new worlds of use for plastics



Final step in making die of 3M Brand Tooling Compound 112—preform of treated metal powder is set in liquid resin for impregnation and cure.

NEW compound cuts die costs 50% to 90%

Now, with 3M Brand Tooling Compound 112, there's no more time-wasting weighing or mixing . . . no more pot-life or toxicity problems that go with conventional plastic tooling compounds.

And there's no waste of materials, either! You pour only as much aluminum powder and resin as you need; return excess of each to its container. The result: big savings in time and materials that actually cut die-making costs from 50% to 90% below the cost of metal dies.

It's simple: the metal powder is packed into the pattern and dried to a preform of good "green strength" in hours.

The preform is cured in liquid resin for 12 to 16 hours. The resin soaks in uniformly to provide a dense, uniform, durable die with high-temperature performance and strength to withstand high-speed production.

All sizes of tools can be made from Tooling Compound 112. Because of their high heat conductivity and stability they are easily machined, wet-sanded or buffed. Tooling Compound 112 is ideal for making compression-molding and vacuum-forming tools. And it is being used successfully to make injection molds and tools for rubber molding and metal-to-metal bonding.

Cut die production costs through savings on tooling materials and time. Switch to Tooling Compound 112 now! For full data, write: *3M Company, Dept. WU 58, St. Paul 6, Minnesota.*

Hastings Chemical Division • Chemical Products Group

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY CHEMICALS

EACH NB & C. INJECTION PRESS ENJOYS TWO YEARS GUARANTEE

NB&C

INJECTION PRESSES
ENSURE FIRST-CLASS
GREAT PRODUCTIVITY
CUTTING DOWN COSTS

powerful newly-conceived, built-in oildynamic circuits

increased plasticizing capacity

higher injection rapidity

SPECIFICATIONS

model	NB 28	NB 30 Record	NB 40	NB 60 E	NB 100	NB 120 E	NB 160
injection capacity oz.	1	1 ÷	1.4	2.1	3.5	4.2	5.6
hourly plasticizing capacity lbs.	6.6	12	15.4	28.6	26.4	53	39.6

			FULLY AUTOMATIC				
model	NB 220 E	NB 360/520 E	R 01	R 02	R 6 FA	R 12 FA	R 20 FA
injection capacity oz.	8	13-19	0.53	0.85	2-3	4-6	8-12
hourly plasticizing capacity lbs.	75	97	7.7	7.7	29	53	75

ASK FOR LITERATURE!

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EPON® RESINS

. . . *preferred for potting*

If potting, laminating, sealing or encapsulation are factors in your operation, you should investigate Epon resins. Because they provide a unique combination of desired electrical and physical properties, they are finding increased use in many phases of the electrical industry.

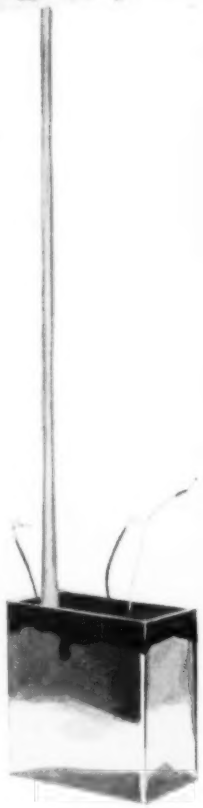
Potting and Encapsulation . . . Epon resins offer remarkable adhesive properties, forming strong bonds to metals and glass, and creating airtight enclosures for sensitive components and vacuum tubes.

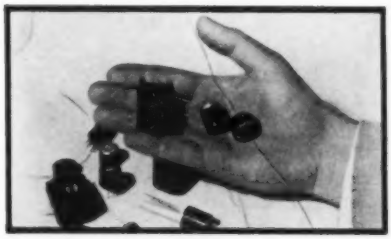
Sealing . . . Epon resin-based compounds are ideal for moisture sealing even at elevated temperatures.

Laminating . . . Epon resin, laid up with inert fibrous fillers, produces laminates with superior dielectric properties and moisture resistance. Epon resin laminates can be dip soldered, sheared, punched and drilled, and provide *excellent dimensional stability.*

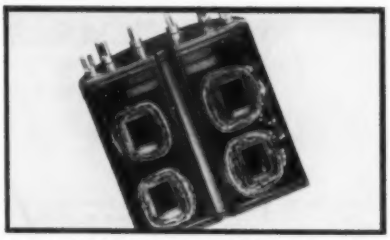
And, solvent-free Epon resin adhesive formulations . . . between glass, metal, or plastic . . . *cure at room temperature with contact pressure alone.*

Can Epon resins solve a production problem for you? For assistance and technical literature, write us now.





These miniature electronic components potted in Epon resin will withstand solder bath temperatures and retain excellent dimensional stability.



Sections of magnetic amplifier coils, when embedded in Epon resin, have exceptional resistance to solvents and chemicals

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION

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SHELL

The Plastiscope*

October 1958

News and interpretations of the news

By R. L. Van Boskirk

Section 1

Activity on the polypropylene front. Half a dozen companies crowded into the polypropylene news last month, with new arrivals and price reductions creating most of the excitement. Hercules, quickly followed by Montecatini's representative (Chemore Corp.) in the United States, lowered the boom on prices by announcing a price of 49¢/lb.—a 7¢ reduction and the second in eight months: total reductions, 14 cents. High-density polyethylene, with which polypropylene is often compared, is now 43¢ and conventional polyethylene 35¢, but the density of polypropylene ranges from .089 to .090 compared with 0.915 to 0.960 for polyethylene.

Hercules also announced a new general-purpose polypropylene with light color, greater transparency, and better heat stability; another that offers long-term stability at elevated temperatures; and a food grade material that has been submitted to the FDA for approval.

Stabilizers are key to performance. The stabilizing systems developed for polypropylene by Hercules are thought to be the answer to critics who have held that the material would oxidize too easily, would not maintain high heat resistance for long periods of time, had poor color, and might be toxic because of the use of certain stabilizers.

In the Hercules system, various stabilizers are used for different material grades, such as electrical, thermal, outdoor durability, and food. But if the customer wants the maximum heat resistance, he may have to sacrifice color and vice versa. A food grade material would have to sacrifice some other property to gain absence of toxicity. Another example would be polypropylene for connectors in automotive wiring under the hood that have to withstand high heat for long periods, but would cost a few cents more per pound. The Hercules Pro-fax 6511J general-purpose will withstand 14 days without failure at 133° C., according to company tests, and more than 150 days at 110° C., while Pro-fax 6512J, a heat resistance formula, will go at least 65 days at 133° C. and more than 150 at 110° C. (about 230° F.). Unstabilized polypropylene will fail at these temperatures in only one or two days.

New arrivals in polypropylene. Enjay Co., Inc. has announced that it will be distributor for Humble Oil & Refining Co.'s polypropylene from that firm's plant near Houston, Texas, which is scheduled to have an initial output of 40 million lb. per year starting in 1960. Development quantities will be available soon from a ton-a-day pilot plant. Enjay and Humble are both divisions of Standard Oil Co. of New Jersey.

(*To page* 43)

*Reg. U.S. Pat. Off.

BAKELITE COMPANY • DIVISION OF UNION CARBIDE CORPORATION

RIVER ROAD, BOUND BROOK, N. J.

July 30, 1957

Claremont Pigment Dispersion Corp.
39 Powerhouse Road
Roslyn Heights, L.I., N.Y.

Attention: Mr. H. C. Felsher,
Chief Chemist

Dear Sirs:

The Surfacing and Printing Group of the Bakelite Company is very much interested in learning what inks Claremont would recommend for the flexographic and gravure printing of two of its recently developed products.

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BRONZE GOLDS FOR VINYL

Vinyl products pigmented with these unique materials retain their brilliance after compounding cycles at 350 F for sixty minutes. Light stability is excellent and applications cover the complete field: film, sheeting, coated fabrics, flooring and footwear. Available for solid, star-dust and flitter effects in two shades of gold and copper.

Send for technical bulletin #490 giving complete information.

CLAREMONT *pigment dispersion corp. • 39 powerhouse road, roslyn, l.i.*

The Plastiscope

(*Continued from page* 43)

stress crack resistance, which is always a property that must be closely checked in any polyethylene. For more details, see p. 199.

Epoxy price reduced up to 20%. Shell Chemical Corp. reduced the price of epoxies up to 20% in August and was immediately followed by other producers. The liquid resins used primarily in plastics were cut from 77 to 62¢/lb., while the solid resins used primarily in surface coatings were cut 6 to 53½¢/lb.

Some 40 million lb. of epoxies were produced in 1957, but only 25 million lb. were sold, according to U. S. Tariff Commission reports. The difference may be accounted for by stock build-up and some captive use. Sales have hovered around the 20 to 25 million-lb. figure annually since 1956 and there isn't much indication of an increase in 1958.

About two-thirds of the 25 million-lb. figure in 1957 is estimated for surface coatings. That leaves about 8 million lb. for structural use, adhesives, and encapsulation. The latter two probably didn't use up a million pounds, according to reliable sources. Thus, around 7 million lb. were used for tooling, pipe, tanks, and the like. Tooling failed to grow because of the decline in the automotive field.

Older companies in the epoxy business are Shell, Jones-Dabney, Ciba, and Bakelite. Dow and Reichhold joined the list last year.

Melt index for low-pressure polyethylene. Last month an announcement in this column stated that Koppers is now producing low-pressure Ziegler-type polyethylene with melt indices of 6.0 and 9.0. This was said to be the first time that a low-pressure-processed polyethylene with an M.I. over 5.0 had been made commercially available, but a Bakelite representative later stated that his company had been furnishing a Ziegler-type polyethylene with an M.I. of 7.0 to 9.0 ever since the Bakelite plant came into production. It is called DMDA 6201 and is suggested primarily for injection molding large pieces; the Koppers' material was suggested particularly for film and coating and for molded products that require thin walls. For more information on melt index and how it affects properties, see article starting on p. 83 of this issue.

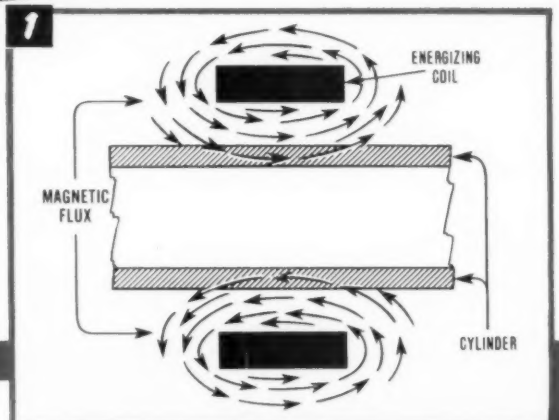
Reinforced polyethylene film. Owens-Corning Fiberglas Corp. is now marketing a polyethylene film reinforced with fibrous glass scrim. The finished product is composed of a layer of scrim laminated between two layers of film and is called FRF (Fiberglas-reinforced film). The most common thickness so far evaluated is 4 mils, which consists of two layers of 2-mil film and the embedded fibrous glass strands. Thicker film can be used if desired. The scrim is 2 by 2 or 4 by 4 (number of strands per inch). It is available in clear, black, aluminum, or black and white colors in rolls 3 and 6 ft. wide or in grommeted tarps up to 40 by 100 feet. Company officials claim that 4-mil FRF is half again as strong as a conventional 6-mil polyethylene film ordinarily used for construction and agricultural purposes.

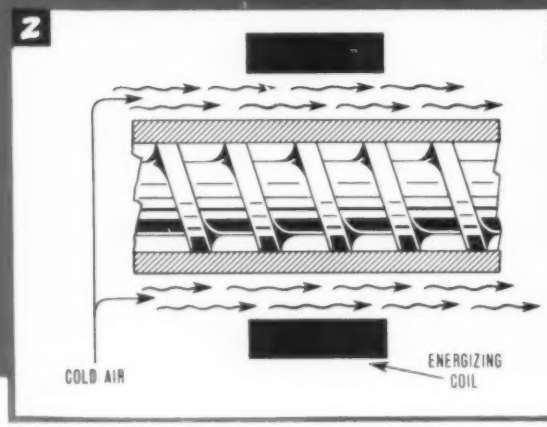
Production of FRF can be accomplished on equipment similar to that used for polyethylene paper coating, with one layer of film performing the function of the paper. Eventually, the layers of polyethylene may be

Let's "TALK SHOP" about

NRM thermoplastics EXTRUDERS

at the SPI Show in November BOOTH 341





NRM INDUCTION HEATING

Magnetic flux from energizing coils causes the necessary extruder operating heat to originate directly in the cylinder walls, as shown in Fig. 1. Cylinder is cooled by passing cold air through spaces between the cylinder and coils, as shown in Fig. 2.

Check with us on such NRM Engineering Advantages as:

INDUCTION HEATING — We'll have an Induction Heated Extruder on display, and will be happy to explain *how* this new method of heating extruders provides for higher quality, closer tolerance extrusions, more production at less operating cost, and virtually no heater maintenance.

AUTOMATIC DIE HEAD CLAMPS — Another NRM "first" . . . and the greatest time saver and work saver ever developed for large extruders. They're for NRM's from 6" up . . . but let us tell you more about them at the show.

J. I. C. ELECTRIC CONTROL CABINETS — No extruder is better than its control system, regardless of its cost . . . We'll show you how NRM Electric Control cabinets enable NRM Extruders to work consistently at the top efficiency inherent in them.

"PACKAGED" INSTALLATIONS—for rigid sheet, for pipe, for film . . . All are compact, integrated units containing every piece of equipment needed for high quality, economical production . . . we'll give you full details at the Show. Be sure to stop at NRM's Booth 341, Nov. 17 to 21, International Amphitheatre, Chicago, Ill.

2987

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SOUTH: The Robertson Company, Rutland Building, Decatur, Ga.
WEST: S. M. Kipp, Box 441, Pasadena 18, Cal.
CANADIAN: F. F. Barber Machinery, Ltd., 187 Fleet St., West, Toronto, Ont.
EXPORT: Omni Products Corporation, 460 Fourth Ave., New York, N. Y.

The Plastiscope

(*Continued from page* 45)

simply extruded over both sides of the scrim. Owens-Corning will sell scrim to any extruder who wishes to make the finished product.

Company claims for FRF compared with conventional film are that it has improved strength, rip and tear resistance (tearing is localized), and dimensional stability so that it will not stretch, bag, or billow. An 8-mil reinforced film will compete price-wise with 10- or 12-oz. canvas commonly used for tarps—and is much lighter. Re-use value is an additional factor.

FRF is suggested for silos, machinery and crop covers, haystacks, pond and irrigation ditch liners, chicken coops, mulching, moisture barriers, crawl space covers, curing blankets, and temporary closures for construction. A 4-mil laminate could also be used for 50-lb. bags and would be less costly than the 10-mil thick bag suggested for chemicals, feed, fertilizer, etc.

Price and date announced for Delrin. It has been two years since Du Pont announced the discovery of a new plastic produced from polymerized formaldehyde: Delrin acetal resin. Molders have been evaluating it for more than a year. The company has now announced that this resin will be available in mid-1959 at an initial price of 95¢/lb., but cost is expected to decline as uses and sales volume increase. The trade expects it to become a large-volume material by 1965 or sooner at a price that will compete with many other thermoplastics. It has strength, toughness, high melting temperature, dimensional stability, solvent resistance, and resistance to deformation that are in many respects equal or superior to nylon; but Du Pont insists that it will supplement nylon rather than supersede it. The trade feels that the material has some of the most interesting possibilities ever discovered in a plastic.

Two new rigid PVC resins. Bakelite Co., Div. of Union Carbide, has announced two new rigid PVC plastics—QGD-5020 for high impact and QGD-5010 for extreme chemical resistance. Bakelite asserts that these materials can be extruded twice as fast as conventional rigid PVC compounds. They have been engineered particularly for pipe and contour applications. Both compounds are available at 42½¢/lb. in truckload lots. Pipe of the QGD-5020 type is already finding use by the U. S. Navy for wash-down of radioactive fallout.

In one test, 2-in. Schedule 80 pipe samples of QGD-5020 withstood ten consecutive blows from a 10-lb. ball dropped 10 feet. In another test, pipe samples were filled with water, stored for 1 hr. at a temperature of 109° F. below zero, and then thrown onto a concrete floor. Bakelite reports that none of the QGD-5020 samples failed; other rigid PVC samples broke.

New approach for decorative laminates. Price Associates, Inc., 1387 Main St., Springfield 3, Mass., has commenced production of melamine laminates having coastal navigation charts as the decorative surfaces. Three products are to be offered: the map laminate for the "do-it-yourself" market, map laminate bonded to ¾-in. birch plywood, and finished cocktail table tops. Master charts of all coastal areas of the continental U. S. will be carried in stock; charts of local bays and harbors will be produced in laminated form on special order.

For additional and more detailed news see Section 2, starting on p. 216

From the looks of things he'd have been better off if he had let his wife do it. Or the maid. Or even the family hound.

For there's no bonafide substitute for a little planning, a little organization. It really pays off in saved time and work and money.

Take custom molding designing, for example. You wouldn't want to call for thin walls adjacent to thick sections . . . or for oblique holes . . . or for engravings on an irregular curve. Of course not!

Well, these—and scores of other costly pitfalls—can be avoided by calling Boonton in *at the beginning.*

That's the easy way to "pack off" the doubts and dilemmas so common to molding jobs . . . the proven way—as others have found—to make sure your job is really "in the bag."

BOONTON MOLDING CO.

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New York Metropolitan Area—Cortlandt 7-0003
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Philadelphia Area—Pioneer 3-0315

THE OUTSTANDING STABILITY OF

DAPON® RESIN

TO IMPROVE PRODUCT PERFORMANCE AND LOWER COSTS IN MOLDINGS AND LAMINATES

Thermal Stability

DAPON resin molded parts exhibit outstanding stability under extreme conditions of exposure to heat and humidity. Under such conditions they do not crack or change shape. For example, after several months exposure to boiling water, DAPON resin molded cups show no degradation of any kind. DAPON resin molded parts are serviceable at temperatures up to 400-450°F. Higher temperature modifications of DAPON resins are currently under development.

Dimensional Stability

DAPON resin exhibits almost no shrinkage during cure and no shrinkage following cure. The lack of post-mold shrinkage makes possible formation of complex matching parts with close tolerances and small or large metallic inserts without cracking.

Chemical Stability

DAPON resin compounds are extremely resistant to acids, bases and organic solvents even at high temperatures, as well as to staining and color degradation.

Electrical Stability

DAPON resin molded parts are noted for the retention of their excellent insulation resistance, dielectric strength, and arc resistance even after exposure to high humidity and to elevated temperatures. DAPON resin's unusual chemical stability insures absence of breakdown and attendant corrosion of metallic electronic components under the most severe conditions of use. DAPON resin is unmatched by any other plastic in this regard.

Color Stability

DAPON resin can be compounded in pastel colors which exhibit greater color stability at elevated temperature than any other known colored plastics.

For Help In Solving Your Problems

Write today for technical literature detailing properties, uses and methods of application for DAPON resin.

*DAPON Resin is Food Machinery and Chemical Corporation's registered trade name for its brand of diallyl phthalate prepolymer. Names of compounders of DAPON resin molding powders are available on request.

OHIO APEX

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Chemicals and Plastics Division

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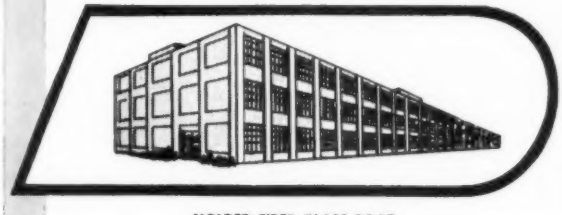

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MEMO TO MEN
ON THE WAY UP

WHERE THERE'S BUSINESS ACTION THERE'S A BUSINESSPAPER

Used to be a song, back in the Thirties, titled, *Little Man, You've Had a Busy Day*. Didn't mention the Big Man. But his days are busy, too. He's the man who must make top-level decisions in business. And to make those decisions, he must have facts. All the facts. All the pertinent information he can get.

He finds time, in his busy days, to get that information. How? By getting a major portion of it from one unique source: the business publications serving his particular field.

No businessman, Little or Big, is fully informed until he reads his businesspaper. He reads it for profit, not for pleasure. He searches it through for news of the trade or industry. For facts. For fresh ideas. For new products he can put to work. And he reads the advertising with the same intense concentration he devotes to the editorial pages.

For the man on his way toward becoming a Big Man, his businesspaper is especially important. Take a tip from the reading habits of key men at every level. Take out a subscription of your own. Then, make the time to read every issue—and read it thoroughly.

WHERE THERE'S PLASTICS BUSINESS THERE'S . . .

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One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

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NEW HORIZONTAL INJECTION PRESS FOR PLASTIC MOLDING

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PLATEN APERTURE : 59 "

MOULD-CLOSING TRAVEL : 47 1/4"

MOULD-CLOSING PRESSURE : 850 tons

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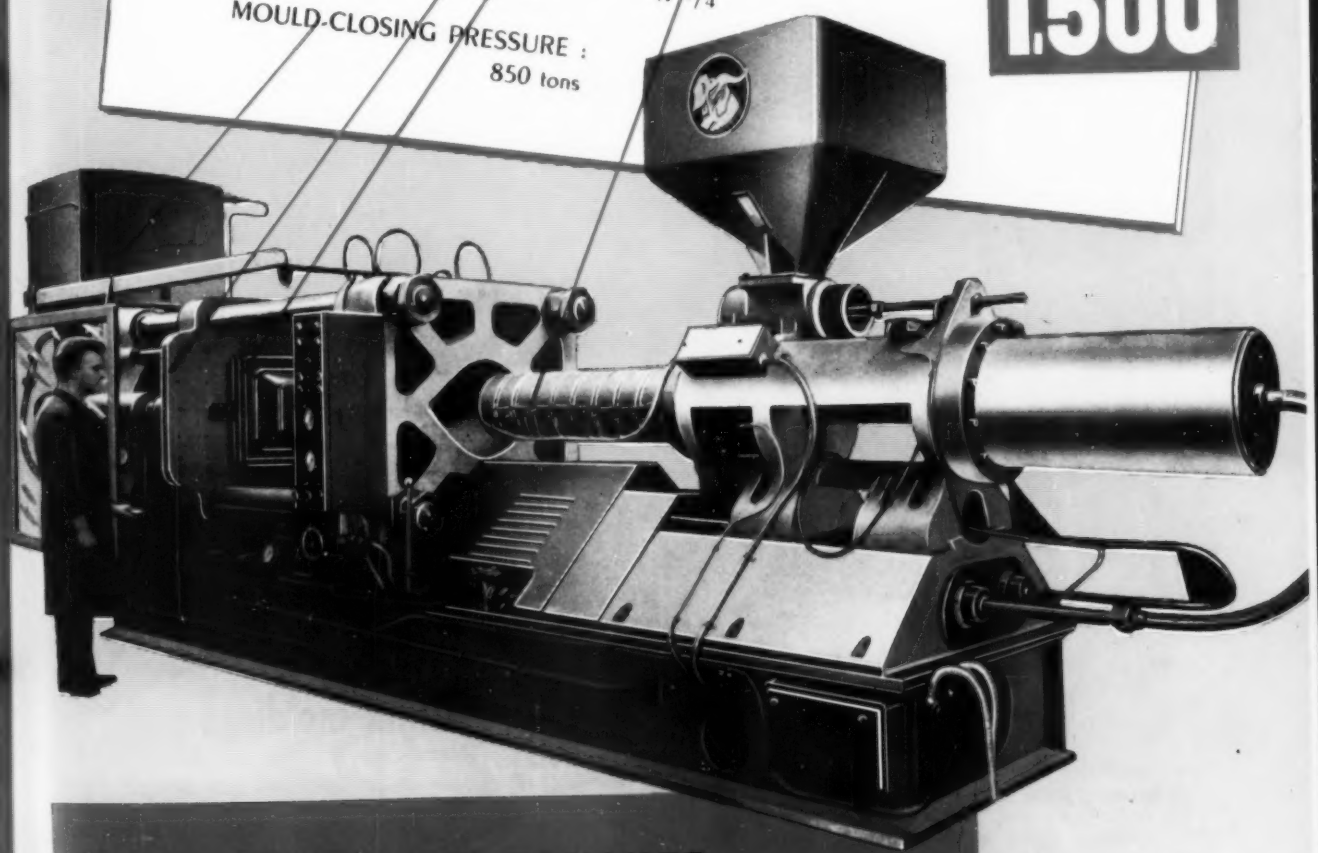

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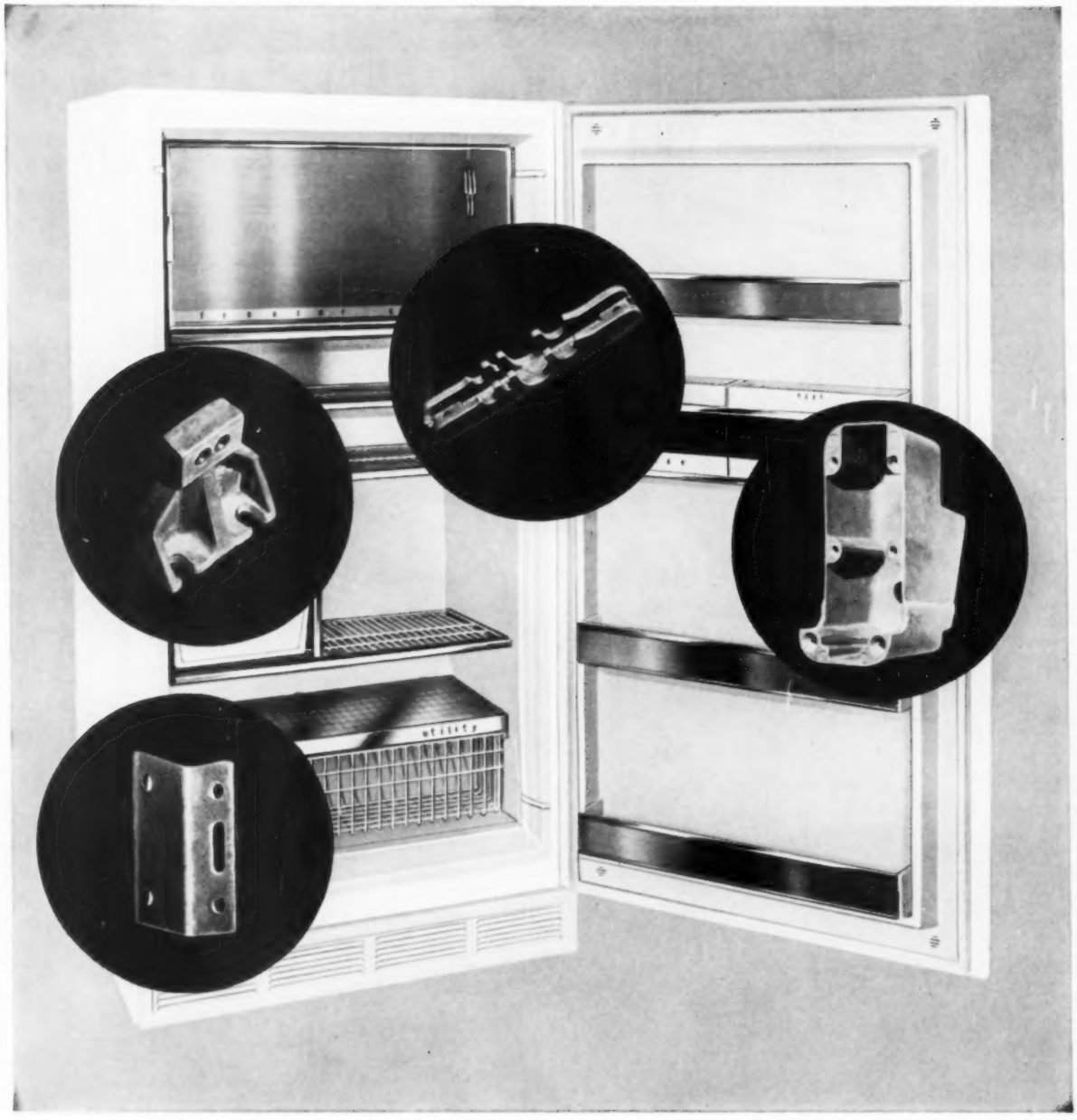

Kelvinator gets big benefits from premix moldings

Premix moldings are making an important contribution to performance of Kelvinator refrigerators.

Strike mounting plates, tie-straps, tubing retainers and lock housings for the Kelvinator are all premix moldings. They've proved tough and resilient . . . excellent shock absorbers. And their thermal insulating properties contribute to the economical operation of the refrigerator.

When resins and reinforcing fibers are blended beforehand, moldings are stronger, wall thicknesses more uniform, weak spots are eliminated. Small and large, simple and complex, premix moldings are not only improving products but cutting costs for hundreds of manufacturers.

If your product calls for strong, rigid, reinforced plastics, look into premix moldings made with Dow vinyltoluene or Dow styrene. Get the names of molders and suppliers from your nearest Dow sales office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 2207F-1.

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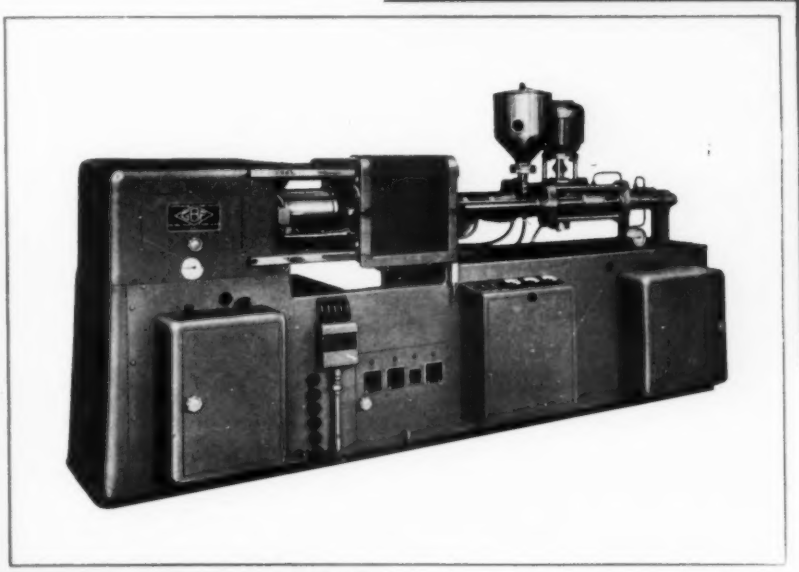
NEW DEVELOPMENT

DYNAMIC PREPLASTICIZER
FAST INJECTION SPEED

G. B. F. "PLASTINIECTOR"
world patent

moulds better
moulds faster
self-contained
fully automatic
all hydraulic



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capacity: 4 oz.
7 c. inch

ADVANTAGES:

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2. Total pressure directly on the material.
3. Extremely fast injection.
4. Exact weight of each shot due to the volumetric injection of the preplasticized material.
5. Low injection pressure.
6. No change of container for the various materials and colours.
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*TITANOX is a registered trademark for the full line of titanium pigments offered by Titanium Pigment Corporation.

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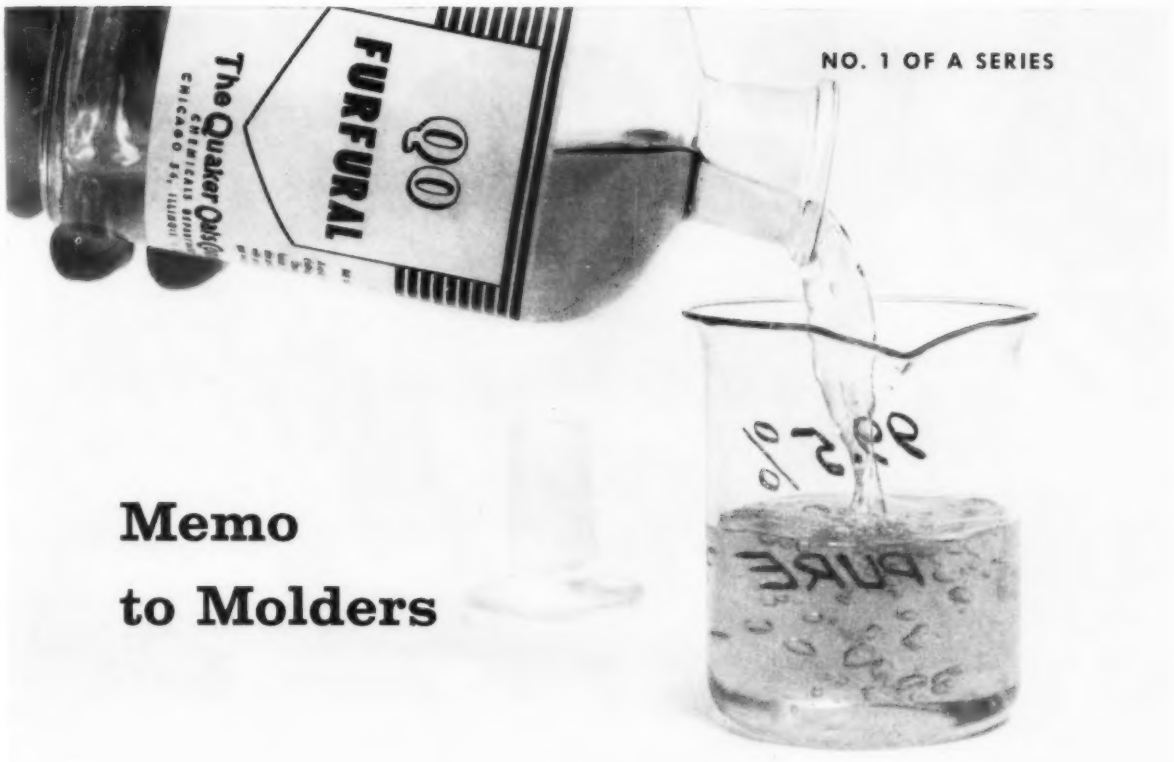

NO. 1 OF A SERIES

Memo to Molders

PURE CHEMICAL–PURE LOGIC
QO® FURFURAL FOR PHENOLICS

Furfural is a highly purified synthetic chemical, with broad industrial applications. For example—nylon is made from furfural. Premium grade lubricating oil is refined with it. Furfural is a key factor in the manufacture of butadiene—principal component of GR-S rubber.

AND . . . furfural is the same pure chemical which contributes important improvements to phenolic molding.

Molding Advantages of Furfural Phenolics

- **Excellent long flow characteristics**
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- **Less sticking in the mold**

Your phenolic molding compound supplier gives you an extra value when he uses furfural. It's a mark of quality.

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You too, will discover that the PEERLESS process of marking plastics is out-of-this-world. Practical, and yet inexpensive, is the PEERLESS method of trade-marking, identifying, and decorating parts and products made of plastics, paper, wood, fibre, leather, fabrics, etc. Engraved and embossed effects at high printing speeds . . . wide range of colors, including gold and silver. Stamping presses to meet every need . . . hand, electric motor, compressed air . . . semi to fully automatic feed and delivery. A PEERLESS Roll Leaf "label" does not wear or rub off, because it is engraved into the surface of the material, forming a permanent, integral part of the product. If you want proof of this "out-of-this-world" PEERLESS process of plastics marking, write or phone for samples or ideas.

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- Reduce Production Problems
- Cut down on "Rejects"
- Help Produce a better Product

AND
SAVE YOU MONEY

HELP YOURSELF TO THESE BENEFITS NOW

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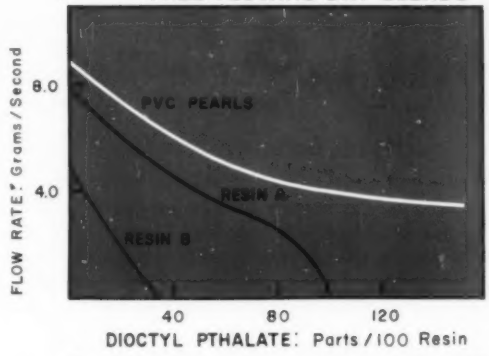

Compare the flow rate of Escambia PVC Pearls at various plasticizer levels with conventional resins ("Resin A" and "Resin B") in the chart above. (Tests made through 60° stainless steel funnel having a ½-inch opening.)

with **ESCAMBIA PVC PEARLS in YOUR PRODUCT**

FOR MORE INFORMATION read "Dustless PVC Eases Processing" an article appearing in the June 1958 issue of Modern Plastics Magazine. If you missed this discussion of the advantages of this unique new polymer, order reprints below.

ESCAMBIA CHEMICAL CORPORATION
261 MADISON AVENUE
NEW YORK 16, N. Y.

Gentlemen:

Please send me copies of "Dustless PVC Eases Processing"

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Plastic Hubs for Roller Skates Molded Economically with Lustre-Die

They needed an injection molding die capable of forming plastic roller-skate hubs by the tens of thousands—a die which would be economical for long runs, and yet have the ability to impart an unusually high sheen to the finished product.

DISTRIBUTOR SAYS, "LUSTRE-DIE."

The die-maker, Plas-Tool Co., Skokie, Ill., put the problem up to our local tool steel distributor, Peninsular Steel Co., who recommended Lustre-Die tool steel on the basis of past experience.

PRODUCES 7 MILLION PIECES

The 24-cavity die was put to work in an 8 oz press, molding rigid polyethylene. The plastic parts were molded by Precision Plastics, Inc., Mishawaka, Ind. The performance of the die was excellent, for the manufacturer was able to produce more than 7 million sparkling pieces. And there wasn't any need for redressing.

LUSTRE-DIE TAKES HIGH POLISH

Lustre-Die is just the ticket for plastic molding because it takes such a bright polish. In fact, its basic analysis is perfect for working with plastics. But to further improve its excellent properties, we add a special alloy fortification; and we furnish the steel oil-quenched and tempered, ready for machining and polishing.

Lustre-Die is melted in the electric furnace, and is painstakingly inspected to insure cleanliness. It's free from porosity and surface pitting. Best of all, it takes a mirror-like finish.

Choose Lustre-Die for your next plastic-molding job. Your Bethlehem tool steel distributor carries it in stock, and will be pleased to work with you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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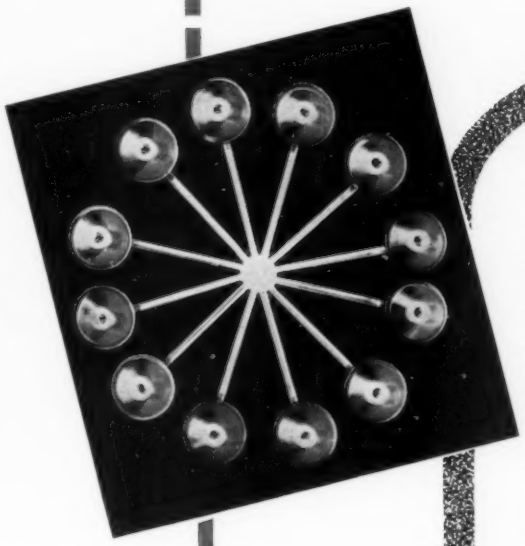
BETHLEHEM TOOL STEELS

BETHLEHEM STEEL

Polythene cone lined CLOSURES



. . . made by JOHN DALE LTD., New Southgate, London N.11, afford the perfect method of closure. They can be sealed, unsealed and re-sealed by the slightest twist. Though resilient to conform to the mouth of the container they are tough enough for high-speed capping machines. Chemically inert and solvent resisting, the polythene liners must be precision molded to the closest tolerances. For trouble-free rapid precision molding, John Dale Ltd. rely on

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12 impressions
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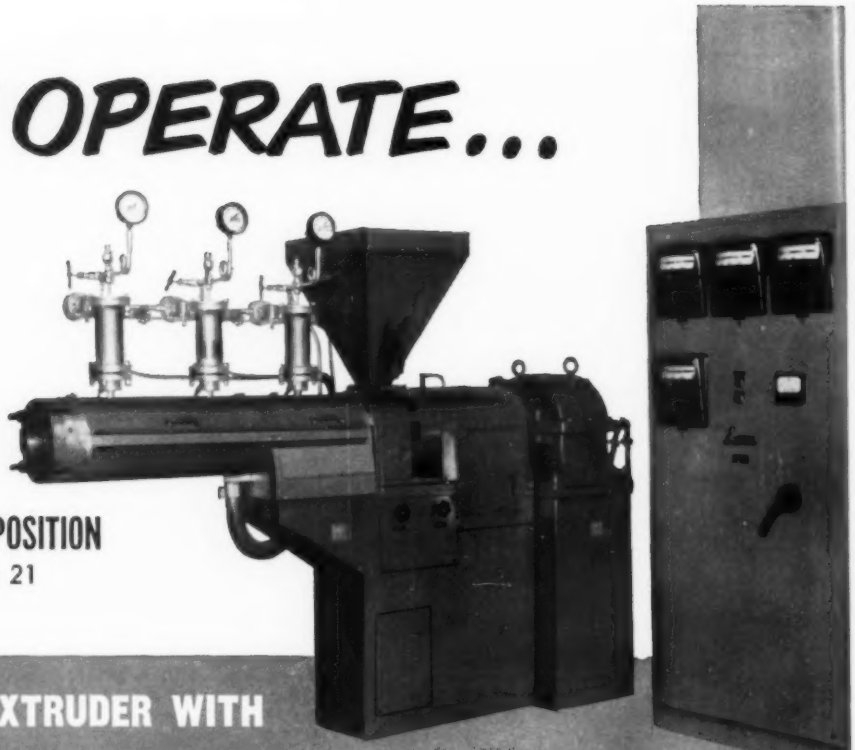

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November 17 through 21
Booth 99

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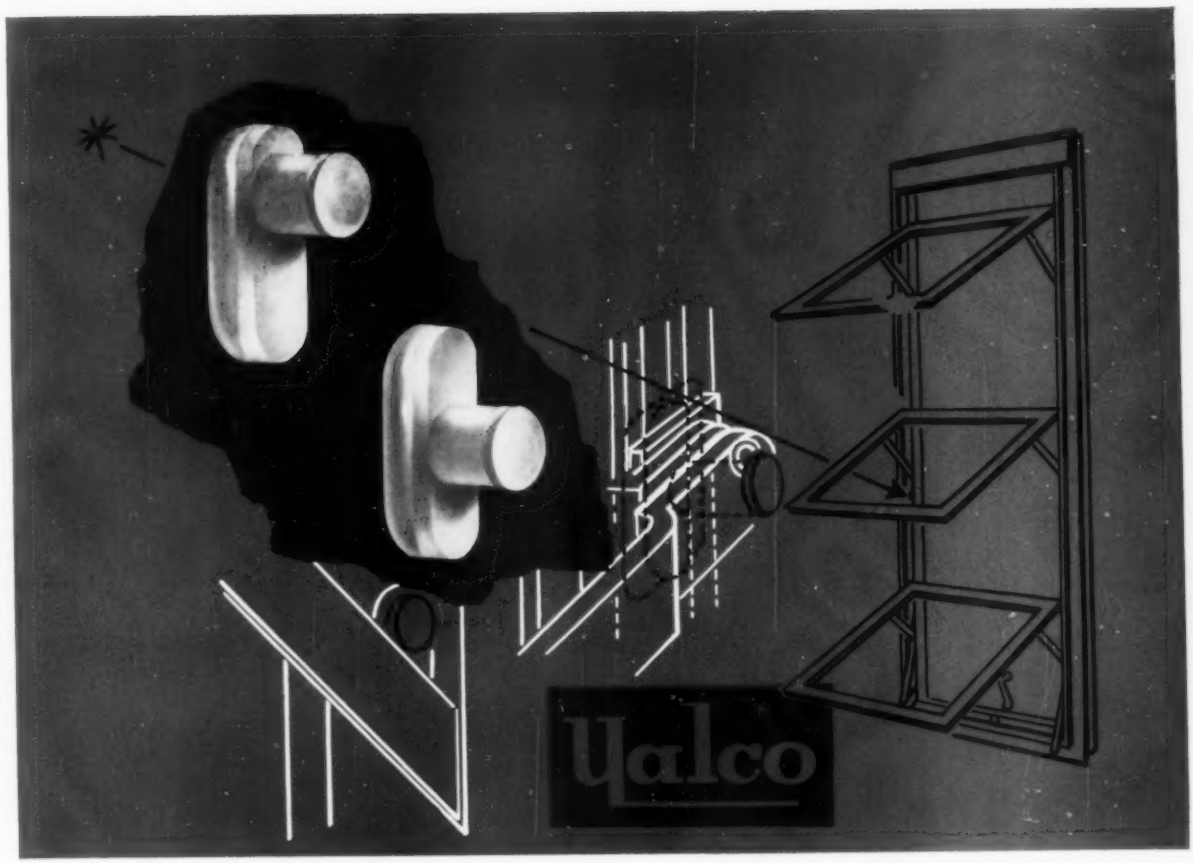

Molded Nylon Parts by . . .

Quinn Berry of Course

Contributing vitally to the smoothly noiseless operation of Ualco Residential Awning Windows, are these molded nylon parts engineered and produced by Quinn-Berry.

In the linkage controlling the raising and lowering operation, these parts, actual size as shown above, function not only quietly and smoothly—they are tough, wear resistant "bearings" concealed within the aluminum frames. The high quality molded nylon parts add an extra value to these popular windows made by Southern Sales Sash and Supply Co., Inc. of Sheffield, Alabama.

This is but another example of the diversity of Quinn-Berry capabilities in engineering and producing components of molded thermoplastics to improve end products in world wide daily use.

Consult with us in full confidence that here, at Quinn-Berry, the "Unusual is Routine". We can serve you well.

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Trevarno makes it tougher than you think

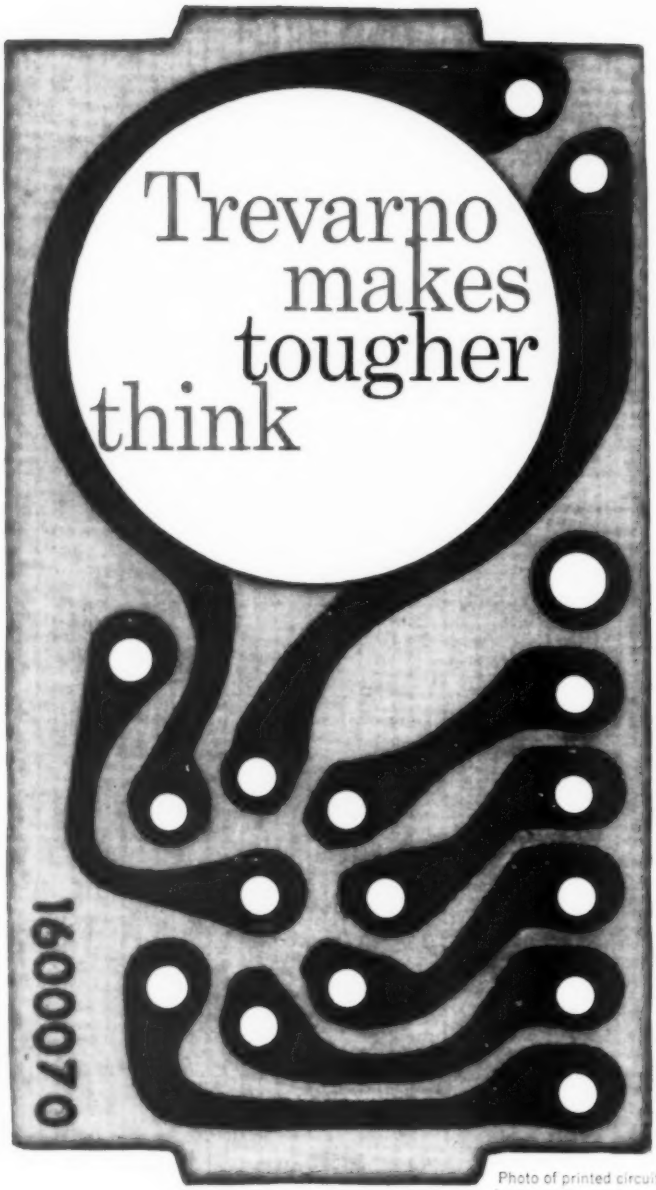
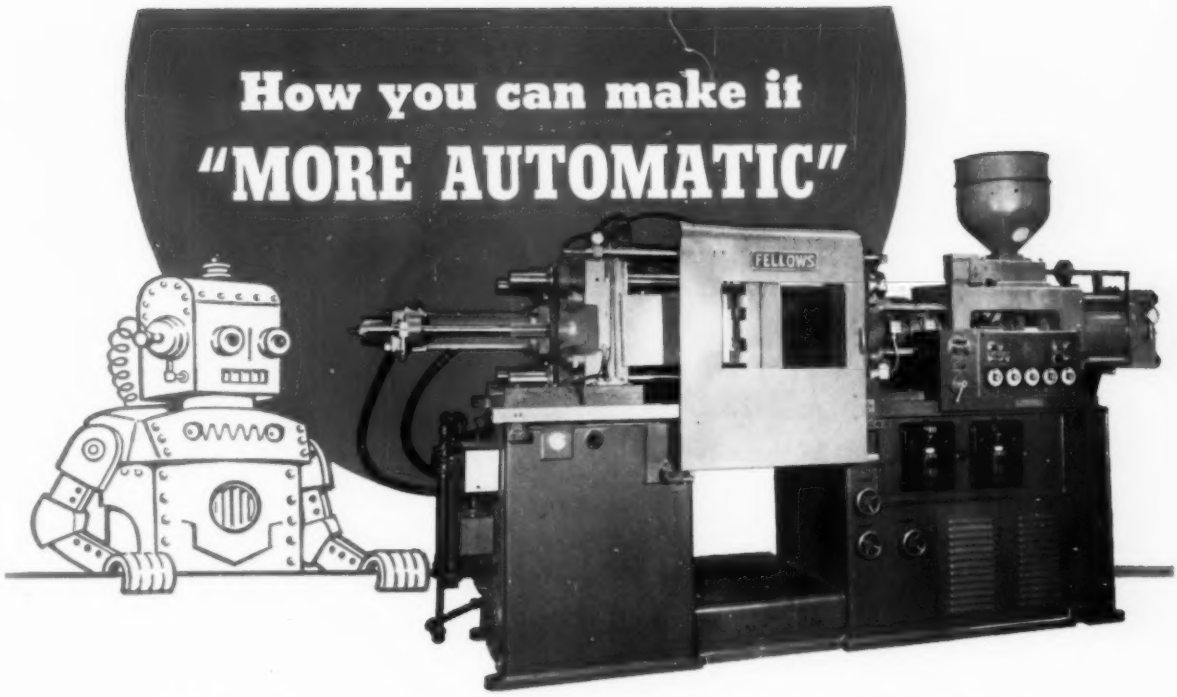


Photo of printed circuit—four times actual size

This sound amplifying circuit, printed on Trevarno resin impregnated glass fabric, speaks up under conditions tougher than you can imagine. It operates at peak efficiency under the most severe conditions of vibration, heat and humidity in Navy submarines. That's why it must have tough insulating backing that won't shrink, swell or bend; resists temperatures of more than 500° F. Laminated of Trevarno epoxy impregnated glass fabric by the Mica Corporation, "Micaply" backs up printed circuitry produced by Etching Company of California for military craft both in the air and under the sea. If you want to make a product better Trevarno's staff of experts is ready to help you develop new or special materials meeting the most exacting specifications. Write Coast Manufacturing & Supply Company, P.O. Box 71, Livermore, California. Sales offices: 4924 Greenville Avenue, Dallas, Texas; 635 South Kenmore Avenue, Los Angeles, California; 114 North Main Street, South Bend, Indiana. Plants at Livermore, California and Seguin, Texas.

Trevarno
GLASS FABRICS

How you can make it "MORE AUTOMATIC"



Attachments Make Fellows "6-200" FULL-AUTOMATIC on Any Job!

Automatic molding pays off in increased production, improved quality of product and lower production costs. The Fellows 6-200 was designed for automatic molding — either partial or full. Its basic design was so planned that the attachments necessary to accomplish the desired degree of automatic operation can easily be incorporated in the machine.

Solving production problems in the molding of containers, closures, cams and a wide variety of consumer and industrial products having internal and external threads, undercuts and side cores brought about the development of a range of attachments which can readily be added to the Fellows 6-200 according to your job requirements. Look over the list — ask for further information on the machine. See for yourself how you can save money by using a Fellows 6-200 Injection Molding Machine, the fastest and most versatile automatic in its capacity range.

Versatile *Fellows Plans* provide convenient short or long-term financing, let your machine pay for itself out of extra earnings. Ask your Fellows representative for the facts. Just get in touch with any Fellows office.

OPTIONAL SPECIAL ATTACHMENTS

- Prepack and pre-position
- Low pressure mold closing protection
- Dual hydraulic knock-out mechanism
- Front knock-out device
- Press stroke interruption and control
- Press speed control
- Air sweeps for article and runner removal
- Multi-nozzle set-ups
- Extra power packs for high-speed injection
- Power take-off for side-action cores or unscrewing
- Conventional air ejection
- Special press control for insert molding

Fellows

injection molding equipment

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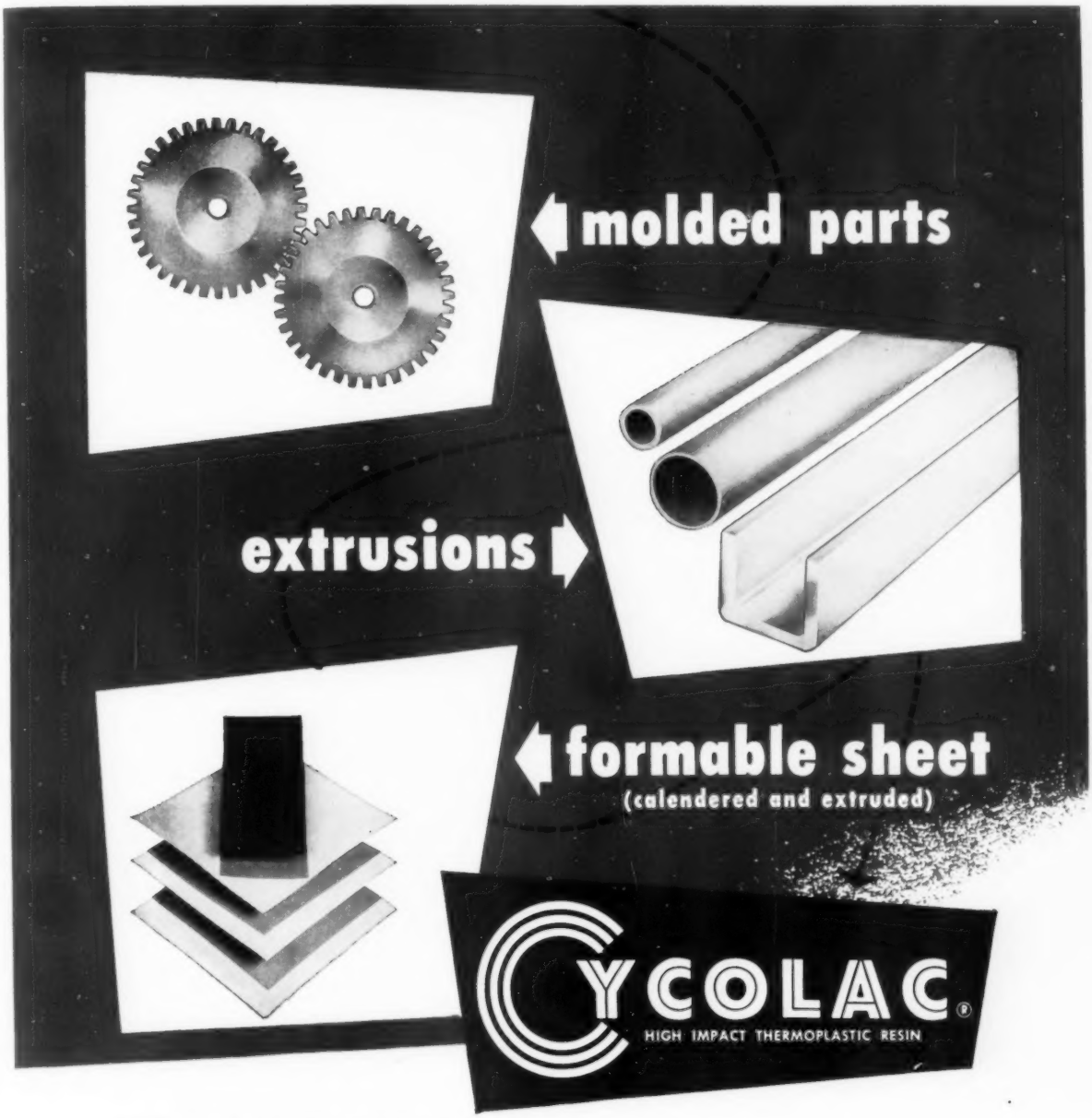

SOME OF THE 1001 END PRODUCTS MADE WITH CYCOLAC

- Kitchen Accessories
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Cycolac now offers you five types of resins . . . each designed to serve specific requirements for better molding, extruding or calendering applications. It will pay you to try Cycolac—it may be your simple solution to many product cost and quality problems.

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Are worn and "weary" sheeting dies costing you too much?

Send your sheeting dies in for Robbins complete 6 point die reconditioning service

You will find qualified die craftsmen at Robbins who can completely recondition your worn sheeting dies and deliver them to you as near like new as possible. Check this 6 point plan now and plan to send your old dies to us soon.

1. Sheeting dies are completely stripped and cleaned.
2. Die is completely refinished.
3. Die is carefully re-polished.
4. Die is completely re-plated.
5. Components worn beyond Robbins rigid standards are replaced.
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Depending on condition of die, work is completed on an average of one to two weeks.

NEW SHEETING DIE PRICE LIST READY
write for your copy today

ACTUAL LIP OPENING	PRICE
38″	$2,950.00
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Excerpt from Robbins New Sheeting Die Price List. These prices include complete die assembly—adapter, set of die lips, heaters and connections.

Here's what you get in a new Robbins sheeting die: *Streamlined flow path. Easier adjustment for control of flow. Heavier construction for rugged operation. Unitized heater banks for easier cleaning.*

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Subsidiary of Lynch Corp., Anderson, Ind., U. S. A.

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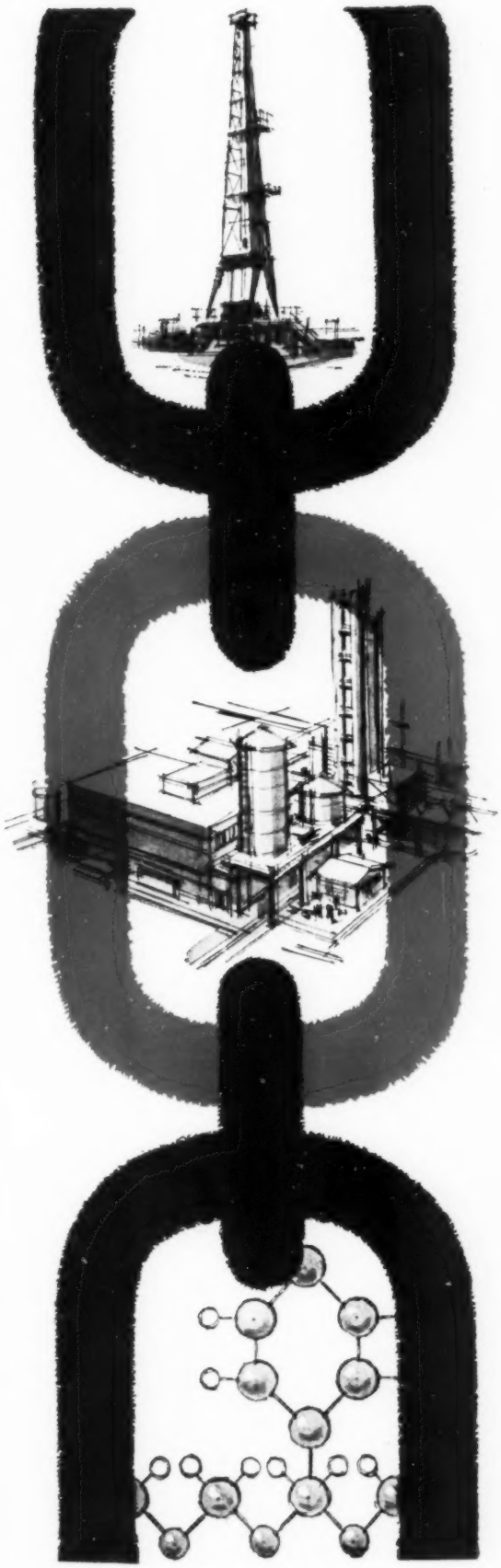

Blaw-Knox supplies vital link in Cosden's crude-to-plastic chain

From crude oil to ethylbenzene to styrene and finally polystyrene—with this pace setting program, Cosden Petroleum Corporation makes oil industry history. In designing and building Cosden's polystyrene plant, Blaw-Knox proudly joins this enterprising company in the vanguard of petrochemical activity.

A unique combination of know-how in resin manufacturing, chemical production and petroleum refining has made Blaw-Knox a leading contractor for industry's most progressive projects.

Perhaps this background of over 90 plastic and resins facilities can be helpful to you. Contact our engineering staff for a conference. Blaw-Knox Company, Chemical Plants Division with headquarters in Pittsburgh. Branch offices in New York, Chicago, Haddon Heights, New Jersey, Birmingham, Washington, D.C. and San Francisco.

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invest in plant that will allow increased and trouble-free production.

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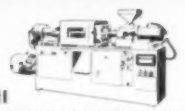
are equipped designed to occupy the minimum floor space thereby allowing extra room for finishing and storage.

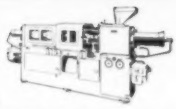
When considering your own production problems and when you plan for higher productivity remember our experience in the design and manufacture of plastics machinery.

Choose R H Windsor LTD PLASTICS MACHINES

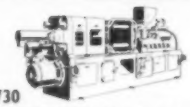


SH1
INJECTION MOULDING MACHINE

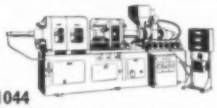
SH3
INJECTION MOULDING MACHINE



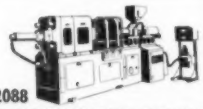
SH4
INJECTION MOULDING MACHINE



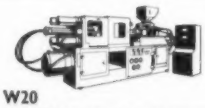
W30
INJECTION MOULDING MACHINE



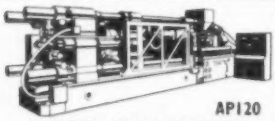
AP1044
INJECTION MOULDING MACHINE



AP2088
INJECTION MOULDING MACHINE

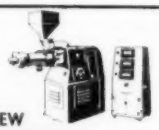


W20
INJECTION MOULDING MACHINE



AP120
INJECTION MOULDING MACHINE

AP335 PRE-PLASTICISER



RC100
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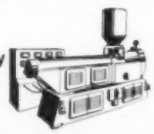
EXTRUSION MACHINE

4½"
SINGLE-SCREW
EXTRUSION
MACHINE



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Double-Face®

READY-TO-USE ADHESIVE FILM CUTS FASTENING TIME & COSTS

Suggested Uses

Double-Face is ideally suited to the temporary positioning of metal, glass or plastic parts in product assembly; roll starting and splicing, lap sealing, bonding of name tags and instruction plates, sealing of plastic film — wherever a quick, strong, pressure-sensitive bond will save materials, time and labor.

Application

Unrolling Double-Face exposes one tacky surface for application to a material. Removal of the release paper immediately, or at a later time, exposes the second side of the film for instant bonding.

Film widths of ½", ¾", 1¼" and 1¾" are also available with a dry edge release paper extending ⅛" on each side of the film to facilitate removal.

For high speed transfer of the film, including automatic removal of release paper, Angier has developed a portable hand applicator accommodating film widths from ½" to 1".

Economical to Use

Typical Double-Face costs range from 10¢ per sq. ft. in 54" rolls to 1/10¢ per sq. inch in average tape widths. The strength of even 1 sq. inch of Double-Face permits many bonds to be made with great savings over the use of conventional fastenings.

New uses found every day for Double-Face Pressure-Sensitive Transfer Film

Pressure-sensitizing polyurethane foam. One side of Double-Face Film has already been applied to foam. Picture shows release sheet being stripped from second side.

Film Form Offers Unusual Advantages

Because of its pliable, pure adhesive body, Double-Face Film conforms readily to irregular surfaces such as embossed materials. It also differs from similar products in its ability to wet into porous materials, such as foams and felt, for stronger bonding without undesirable penetration. The film can be die cut or slit with protective release paper in place. And laminates — with only the film between them — can be bonded to a closer tolerance.

To meet the need for a more convenient instant-bonding medium for a full variety of porous and non-porous materials, Angier Adhesives has developed Double-Face — a pure translucent pressure-sensitive adhesive film. The first product of its type, Double-Face is reinforced by a non-woven tissue, and supported for shipping, handling and storage by a release-coated protective paper.

More Than a Tape

Angier's Double-Face Film is available in narrow "tape" widths, as well as in wide goods, and shipped in rolls. For these reasons it is sometimes confused with conventional adhesive tapes. Yet it is entirely different from single or double coated tapes with a paper, cloth, or plastic base. Double-Face, with its almost invisible reinforcing tissue, provides as much as 4 mils of adhesive — similar to a solution applied coating — whereas most double coated tapes have an adhesive coating in the range of 1½ mils on each side.

Sizes and Strengths

Angier's film is available in three different adhesive strengths: PT-5501 (soft), PT-5502 (medium) and PT-5503 (firm). It is shipped in 72 linear yard rolls in widths ranging from ⅛" up to 54".

Transfer Film No.	Bond Strength (Peel) lbs./inch width	Dead Load (Shear) 100°F 2½ lbs. wt.	Softening Point Load 50 gms.	Softening Point Load 225 gms.	Sustained Dead Load Values in Shear at 75-100°F. *SMOOTH SURFACES bonded with 180° heat and pressure or pressure only	†POROUS SURFACES bonded with pressure only	†POROUS SURFACES bonded with 180° heat and pressure
PT-5501	3.0#	180 secs.	140°F.	110°F.	1 oz.	1 oz.	2 oz.
PT-5502	4.25#	640 secs.	160°F.	120°F.	2 oz.	½ oz.	3 oz.
PT-5503	3.5#	2700 secs.	200°F.	145°F.	12 oz.	½ oz.	5 oz.
ASTM TEST METHOD	D 1000—53 T		D 816—51 T		Values above are all in ounces per square inch		

*like metal to metal, mylar to steel, polyethylene to polyethylene
†like duck to duck, paper to paper, felt to wood

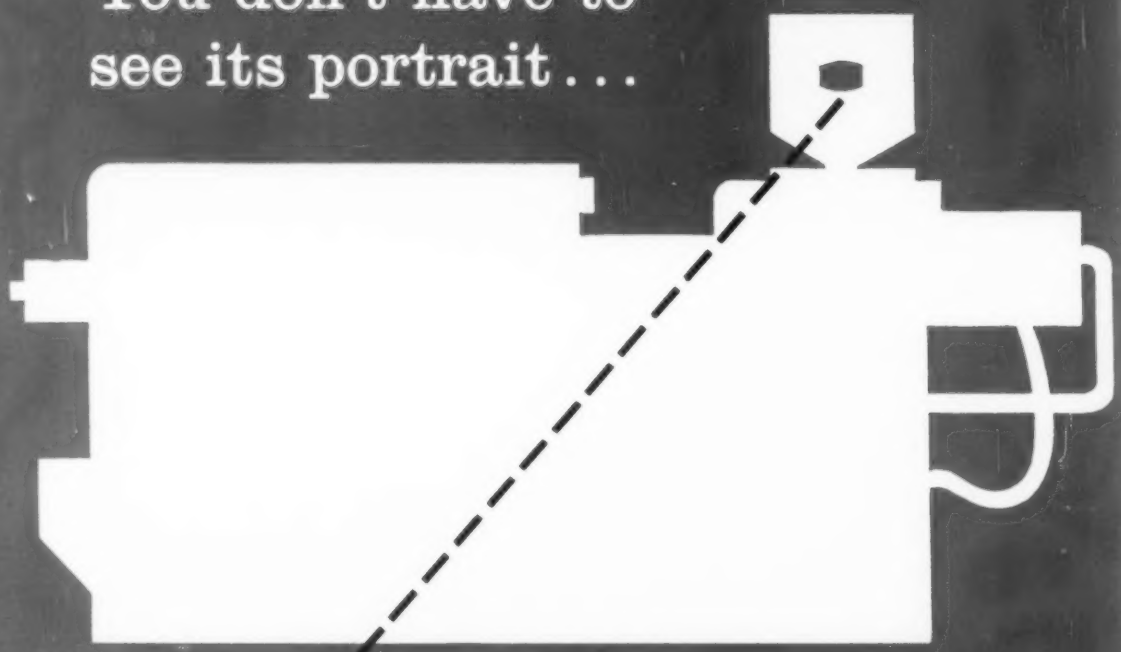
Values listed in this table are averages and are not intended as specifications.

Write to Angier for prices and for further information regarding Double-Face Pressure-Sensitive Transfer Film and your product requirements.

ANGIER ADHESIVES

INTERCHEMICAL CORPORATION
Finishes Division
120 Potter St., Cambridge 42, Mass.
Midwestern Plant: Huntington, Ind.

You don't have to see its portrait...



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If the name is PECO you can take the rest for granted

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These and other advantages are offered in the wide and comprehensive range of Peco machines of ½-60 oz. capacity

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Around the World in 80 Years

. . . plastics parts molded by Consolidated, that is. In every part of the globe — from Scranton, Pennsylvania to Sidney, Australia — people are using and enjoying products made more dependable by components from Consolidated. Now, with two plants working for you in Scranton, Pennsylvania, and one in Binghamton, New York, we are better prepared than at any other time in our 80 year history to take care of your requirements.

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Consolidated Molded Products Corporation

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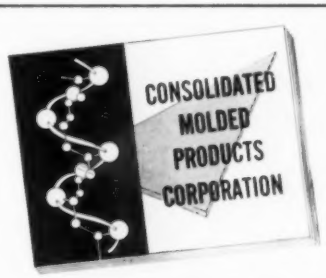
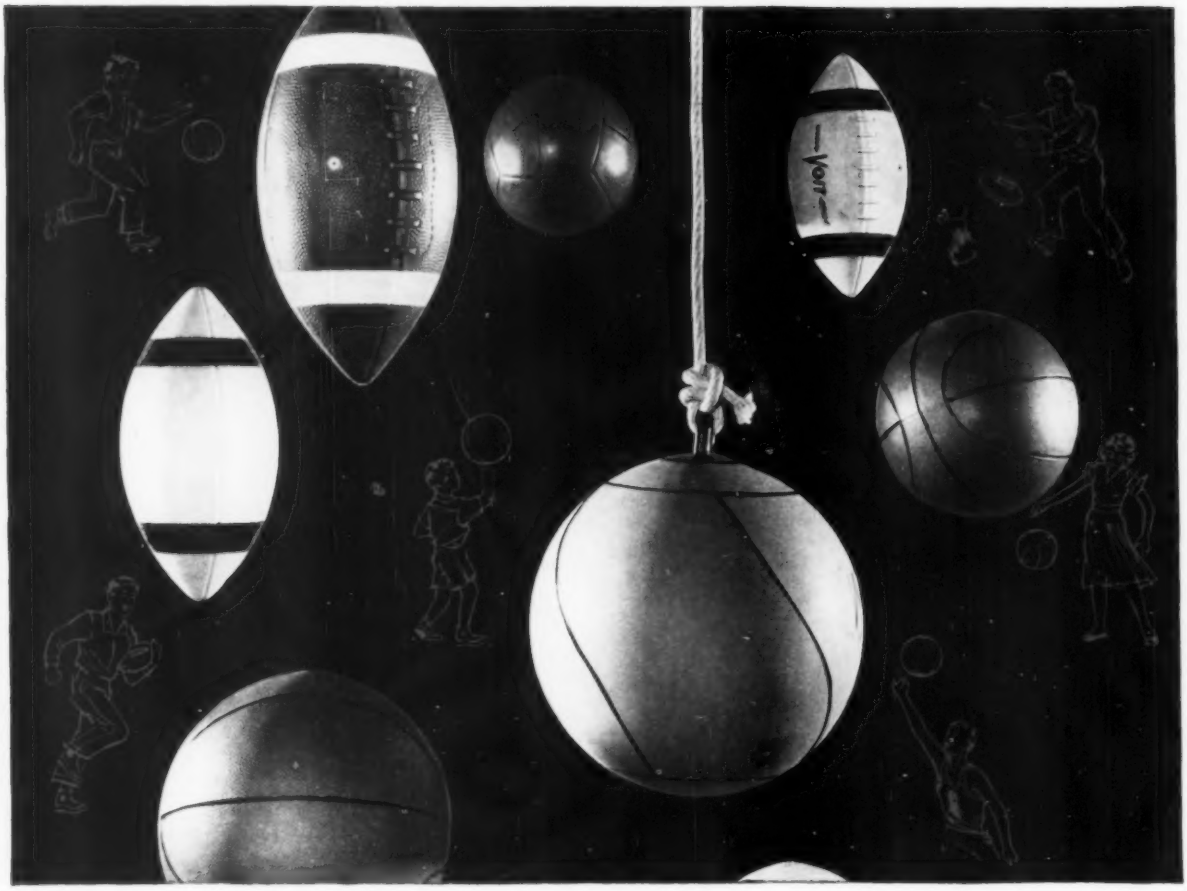


Admex Product · of · the · Month



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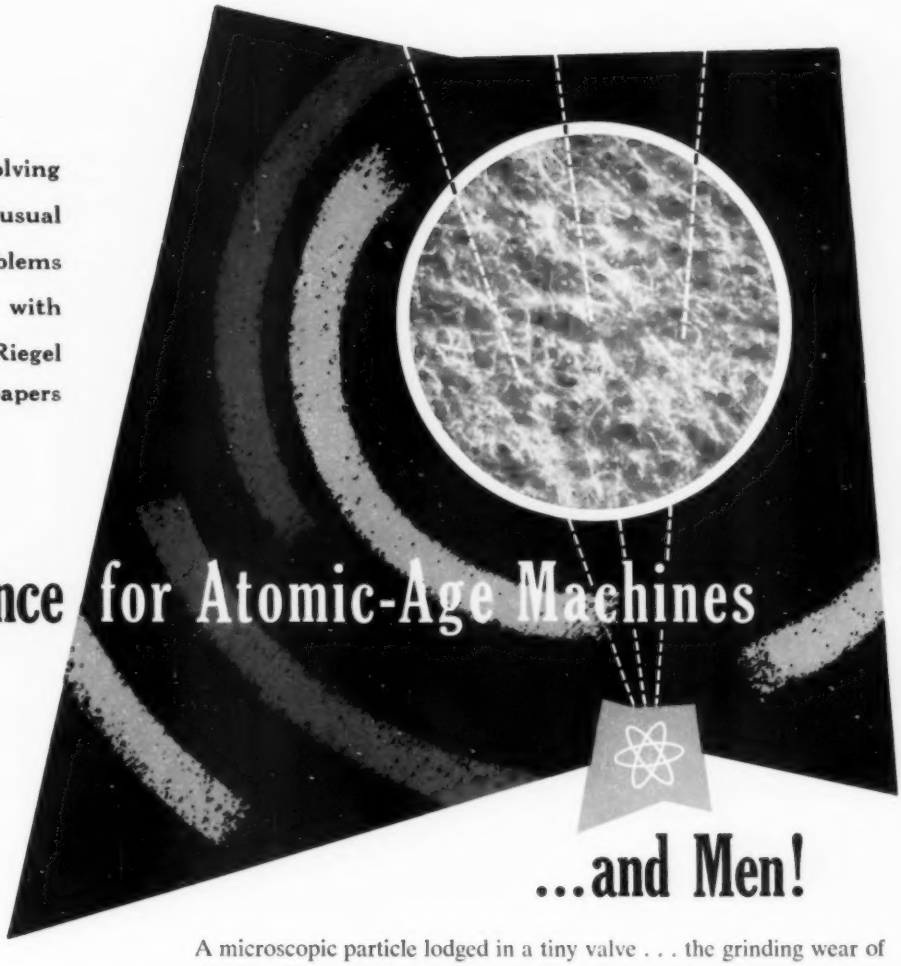

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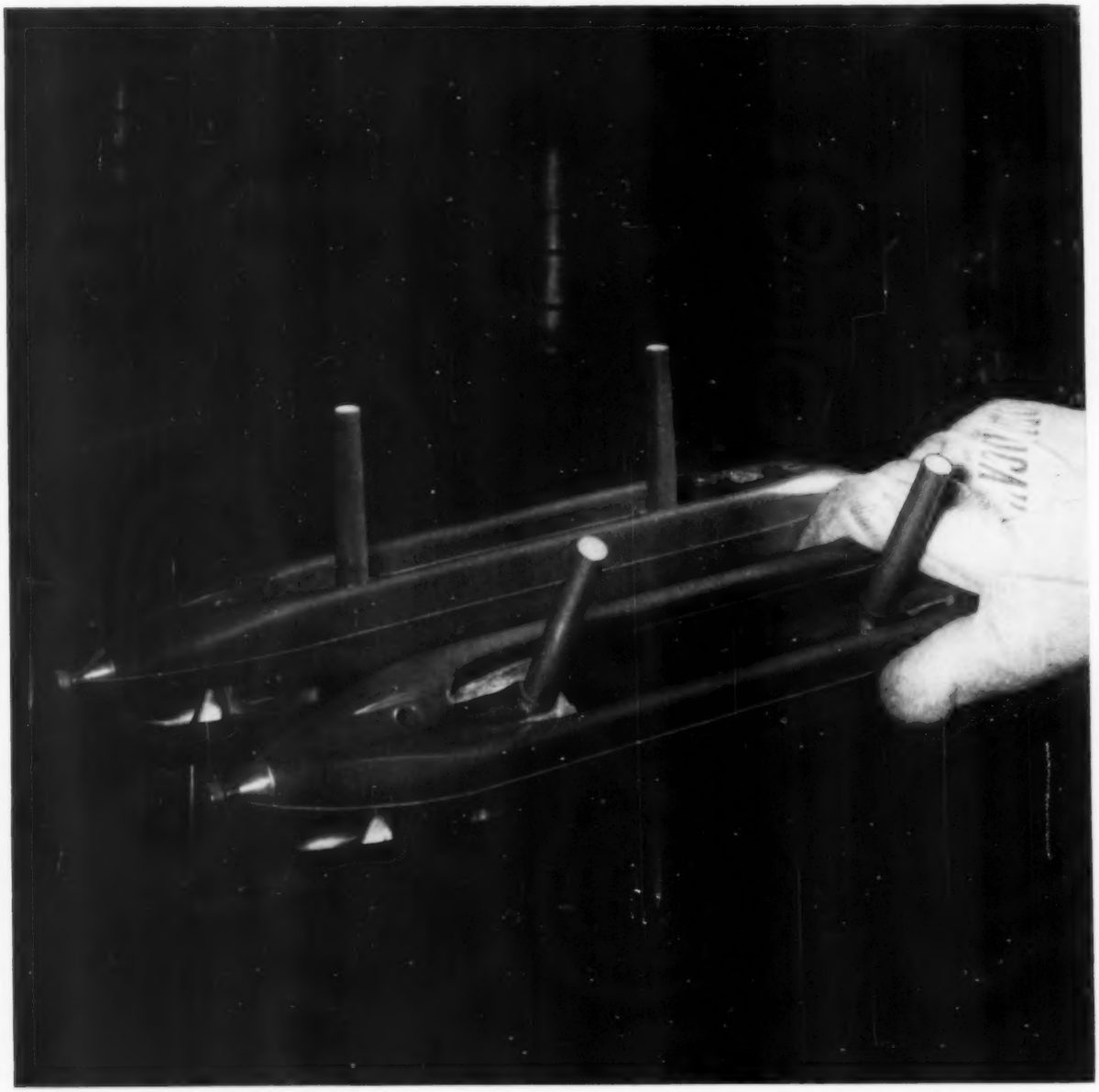

STAND-IN FOR NATURE – Despite the long dominance of the dogwood tree as a basic raw material for the production of quality textile shuttles, plastics have been making remarkable inroads, recently, as an alternate material. This unique shuttle is made entirely of resin impregnated duck and is the result of nearly ten years of intense research and development by Draper Corporation, and Formica Corporation. The sidewall inserts are cut beforehand from a special, pre-cured laminate. Then, the entire shuttle is formed by a combination of compression and plunger moulding. The result is an unusually sturdy shuttle which Formica Corporation claims will last at least twice as long as the best wooden shuttle available. Made for Draper Corporation, the shuttles are produced in nine different models. One of the components used for the laminate with which the shuttles are made is Mount Vernon duck.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

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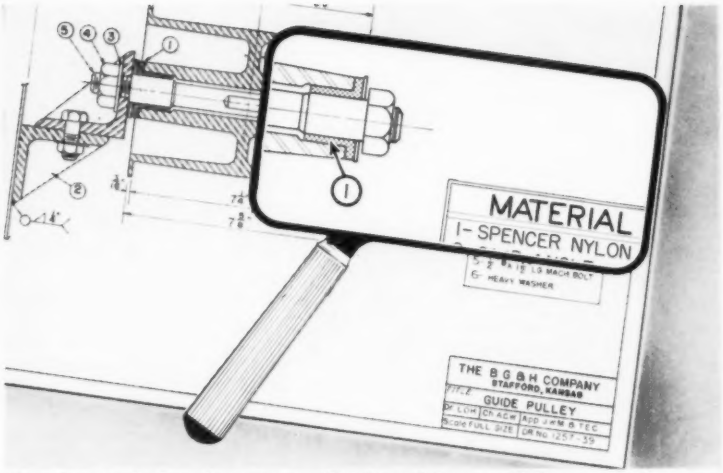


Here is a typical engineering application of Spencer Nylon, a bearing application. Because Spencer Nylons absorb shocks that shatter many other plastics and metals, they are often ideal for use in bearings, valves, and other high speed parts. For example, Line Scale Co. of Oklahoma finds pipeline valves of Spencer Nylon hold up under speeds that would pit brass. And, when one side gets worn, you can turn it over and use the other side.

More flexible than old-type nylons, Spencer Nylon 402 makes possible the easy-fitting Marietta football face guard. Metal-tough, even thin guards give good protection. Yet Spencer Nylon (density 1.14) has less than half the specific gravity of aluminum.

Reports from 4 manufacturers:

"Why I Specify SPENCER Nylon":

Special properties of SPENCER Nylon often outmode metals and other plastics . . .

Specific Spencer Nylons have properties that other materials, including old-type nylons, don't have. In recent months these special properties have won many assignments for engineering applications, and enthusiastic praise from satisfied users. Here are some of the reasons why:

"Spencer Nylon outperforms other nylons in gear applications," says Molding Jobbers, Inc., of Minneapolis. "The first nylon we tested failed under tension. But Spencer Nylon 401 ran as high as 90 ft. lbs. in a torque load test requiring 60 ft. lbs." Another important advantage in gear applications is the fact that nylon is largely self-lubricating.

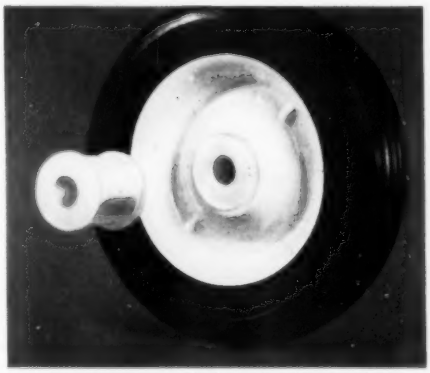
In tough situations—such as in a connection for pumps and tanks—R&K Tool and Die Company finds that pipe fittings made of high impact plastics sometimes give way under vibration strain. Metal is objectionable on the grounds of expense and corrosion. But pipe fittings made from Spencer Nylon 401 are completely satisfactory.

Pounds instead of ounces! Because processability of Spencer Nylon is superior to that of old-type nylons, it is now possible to make far larger injection-molded pieces. Broad molding temperature range assures proper cavity fill and ease of control.

Also, Spencer Nylons are unaffected by most solvents and dilute mineral and organic acids, allowing for a wide range of uses.

You, too, may find that the special properties of one of Spencer's wide range of nylons offers a better solution to your materials problem. For complete information write: Spencer Chemical Company, 515 Dwight Bldg., Kansas City 5, Mo.

"We couldn't burst-test Spencer Nylon 401 pipe fittings," reports R&K Tool and Die Co. of Cleveland. "Our testing apparatus gave out first." Extra toughness of Spencer Nylon makes it ideal for pipe fittings. Also, Spencer Nylon can be milled, drilled, taped, turned, cut and otherwise machined.



"Far easier to mold than the first nylon we tried," says Ray Hodges, molder of nylon wheel bearings. "Cycle time is decreased, and we get fewer rejects." And Spencer Nylon 401 cuts materials costs 70%. Also, the "give" in Spencer Nylon enables it to overcome minor inaccuracies in alignment not possible with steel.

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HERE'S THE STORY ABOUT **Moplen*** POLYPROPYLENE: New thermoplastic material now in commercial production is obtained by stereospecific polymerization of propylene . . . Can be used in production of filaments, yarns and staple fibers. PROCESSING OF MOPLEN (*No. 4 in a series*)

OTHER PROCESSES. Metal surface-casting — The object to be coated is heated to about 250°C (482°F), then dipped into powdered "MOPLEN." Afterwards, it is introduced into an oven where the fusion of the polymer is completed.

Vacuum forming of sheets — This is an excellent technique for large sized pieces or complex shapes and can be carried out using normal machinery, but the sheets should be heated with particular care so that it will soften uniformly and remain stretched.

Welding — Welding is easily carried out by using a thin "MOPLEN" rod and an inert gas welding torch heated at 200-220°C (392-428°F). Follow the various methods in use for polyethylene (butt welding, lap welding, chamfer welding, etc.).

Ink printing — The adhesion of ink to "MOPLEN" is good but can be improved by pretreating the surface with methods used for polyethylene (particularly electrostatic discharge).

Machining and finishing — "MOPLEN" is easily worked on conventional machine tools (lathe, milling machine, drilling machine, etc.).

Comparatively high cutting speeds can be applied.

Resistance to chemicals — "MOPLEN" is resistant both to alkalies and to acids, even at high temperatures. It exhibits no environmental stress cracking when it comes into contact with polar substances.

In Table I some characteristic data are reported.

Solvents and adhesives — There are no solvents for "MOPLEN" at room temperatures. It dissolves only in aromatic and chlorinated compounds at temperatures above 80°C (176°F).

"MOPLEN's" behavior with conventional adhesives is that of any similar plastic.

In Table II some significant data are reported, showing the physical properties of "MOPLEN" after a 30-day immersion test at 20°C (68°F) in several solvents.

Permeability of "MOPLEN" to common gases and vapors is considerably lower (25-50%) than that of polyethylene. The same applies to the diffusion of liquids.

For more detailed information about "MOPLEN" please write, outlining area of interest, to

Chemore Corporation
General Representative in U.S.A. & Canada for Montecatini
21 West St., New York 6, New York

TABLE I

Reagents	Test Days	Conditions Temperature °C	Conditions Temperature °F	Weight Increases %	Tensile‡ Strength Kg sq cm	Tensile‡ Strength Lb sq in	Total Elongation %‡	Notes
Control	—	20	68	———	300	4300	440	———
Sulphuric acid 80%	30	20	68	negligible	293	4160	480	slight coloring
" " "	7	70	158	"	330	4680	400	" "
" " "	7	90	194	"	329	4670	410	" "
" " 98%	30	20	68	"	290	4115	230	" "
" " "	7	70	158	"	330	4680	270	The liquid becomes dark brown
" " "	7	90	194	0.3	335	4750	30	The liquid becomes dark brown and specimen crazes
Nitric acid 50%	30	20	68	negligible	280	3970	335	———
" " "	7	70	158	0.1	360	5110	20	The liquid becomes yellow Specimen crazes
" " 94%	30	20	68	0.2	288	4090	60	———
" " "	7	70	158	6	100	1420	———	Specimen becomes brittle
Hydrochloric acid, conc.	30	20	68	0.2	280	3970	350	———
" " "	7	70	158	0.3	290	4115	330	———
" " "	7	90	194	0.5	320	4540	280	———
" " "	7	110	230	0.8	330	4680	270	———
Sodium hydroxide 40%	30	20	68	negligible	330	4680	380	———
" " "	7	70	158	"	329	4670	360	———
" " "	7	90	194	"	330	4680	350	———
" " "	7	110	230	"	336	4770	300	———

‡ Tested according to A.S.T.M.-D638-52T

TABLE II

Solvents	Weight Increase	Tensile Strength‡ Kg sq cm	Tensile Strength‡ lbs sq in	Total Elongation %‡
———	———	300	4300	440
Motor gasoline	13.2	260	3690	700
Benzene	12.5	265	3760	690
Carbon tetrachloride	41.3	270	3830	720
Acetone	2.0	260	3690	600

‡ According to A.S.T.M.-D368-52T

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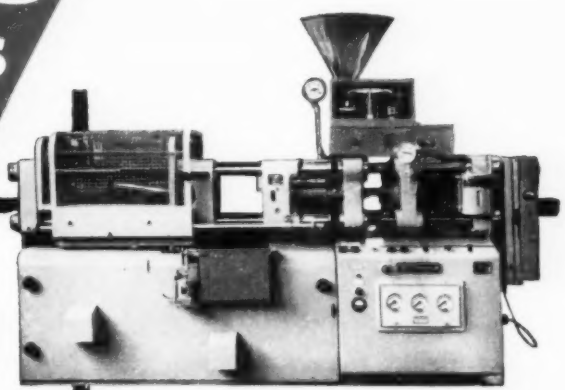

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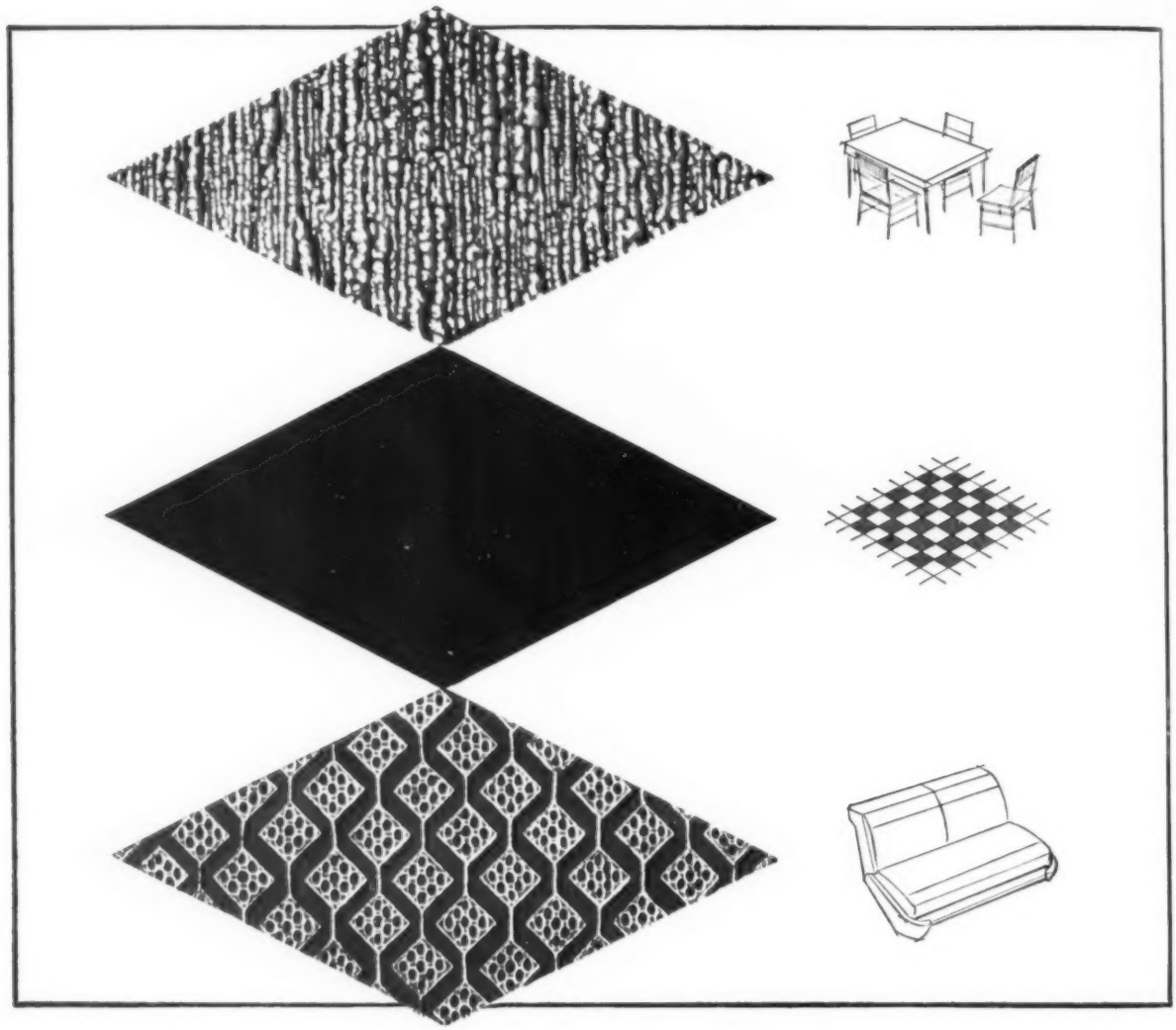

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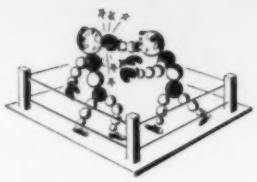
Don't miss . . . in this issue

Polyethylenes—their present and potential—is the subject of our lead article, the first of two. This one deals with molded polyethylene of all kinds—and there are so many kinds and possibilities of other kinds that almost everybody is confused. Melt indices, molecular weight, density, linearity are factors explained in the article, with their relationships to processing ease and product properties shown, and with some discussion of alloys or blends. See "When you want polyethylene, know what you want," p. 83.



Large-scale mat making. Any fibrous material can be deposited from water slurry to form a continuous isotropic felted mat by a new process that filters the slurry through an endless screen under pressure. Filtration is so rapid that fillers and insoluble resins can be laid down with the fibers in constant ratio. The process is now being used to form, from waste paper stock, the core material for decorative laminates. Mixed cellulosic and glass-fiber mats so formed have excellent properties, and may become a factor in reinforced plastics. See "Continuous forming of fibrous mat," p. 115.

Plastics tarpaulins and airhouses are made of many kinds of materials, mainly fabrics coated with different resins. Flat, they are used to cover ball parks, buildings, trucks; tailored to shape they become inflated warehouses, radar huts, portable shelters. For a look at the kinds now made and how they are used, see "They cover a lot of ground," p. 105.

Urethane foam in electronic packages is a new development with great promise. The process can handle irregular shapes and delicate instruments with safety and with weight and cubage savings. In one case, package weight was cut by two-thirds and size by seven-eighths. Read "Encased in urethane foam," p. 89.

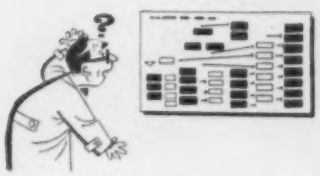
Boom in space toys and hobby kits. With the launching of Sputniks and Explorers came a surge of toy and model rockets, missiles, space stations, and moon ships. Big problem was to get into production fast. Here is how it was accomplished in plastics. See "Space-age toys," p. 102.

Watch plastics development in Japan. A strong desire to be not only self-sufficient, but to command exports in their historic trading areas is leading the Japanese towards expansion in plastics. Plenty of technologists plus low-cost labor are factors. This story, by an American who managed a material supplier's Japanese company for three years, begins on p. 109.

Fluidized-bed coating of plastics. Information on this patented process, which consists of immersing a preheated surface into a fluidized bed of fine polymer particles, has previously been hard to come by. Here is an independent research report that examines in detail its use in coating metals, and high-lights many other possible applications. See "Fluidized polymer deposition," p. 125.

Something new in plastics chairs is a "woven" glass-reinforced polyester unit which doesn't get hot, will not collect water, and has a natural spring. It is molded in one piece but looks like colored cane furniture. Read "New chair concept," p. 88.

More about choice of coating methods. Second of two articles completes survey, covering knife coaters, wire wound bar coaters, air doctors, brush coaters, spray coaters, extruders, cast coaters, calenders. It begins on p. 90. This feature is accompanied by a chart showing how to determine proper coating procedures. It is printed on one side only so readers may remove it and put it on the wall. The chart is found between pp. 90 and 97.



Watch for... Our November issue will be most important reading for manufacturers, engineers, and designers whose purpose is to ease the squeeze between costs and profits . . . It is the pre-National Plastics Exposition number and its theme is "Plastics for Profits" which is also the theme of the Big Show in Chicago, November 17-21 . . . General Section will feature a score or more of case histories in which plastics have replaced other materials with resulting economies or product improvement, case histories where new products have been designed specifically for the use of plastics, and case histories of profit in plastics and plastics product distribution . . . Engineering Section will feature a new method of using valves in the nozzles of injection molding machines for increased production; an article on the design of automatic unscrewing molds; and a survey of TFE alloys and their engineering uses . . . An insert in November will present the program of the convention, a list of exhibitors at the Show with their booth numbers, and a map of the exhibit hall . . . In December, the lead article will present an analysis of the presently changing picture in custom processing . . . what custom processors are doing and propose to do to strengthen their position in a field where captive plants are on the increase . . . Also a follow-up to this month's lead, a second article simplifying the complexities in the selection of polyethylenes and much much more to help you use more plastics for bigger profits.

MODERN PLASTICS

Volume 36
October 1958
Number 2

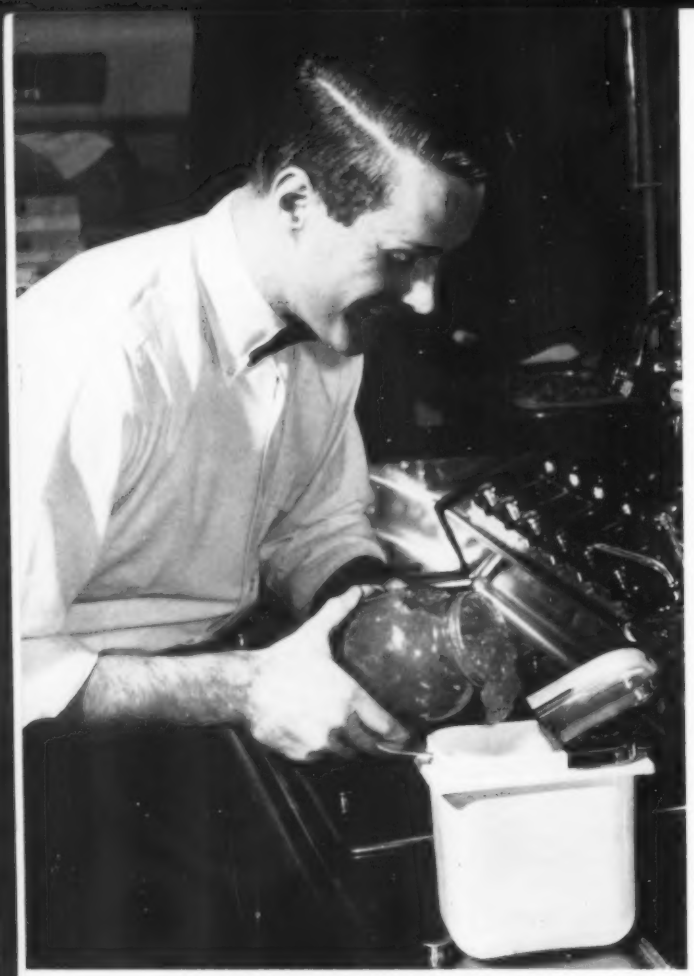
When you want polyethylene, know what you want

First of two articles which point out how the physical properties of polyethylene can be tailored to fit the needs of the process and the application. General discussion, molding materials, and bottles are covered. The second article, in the December issue, will deal with film, pipe, wire coating, and other applications

Here's news for every user and processor of polyethylene: If you are confused by all the different formulations, melt indices, densities, molecular weight distributions, and price variations now current, you are going to be even more confused before things start to get better!

The problem has developed because polyethylenes of all types can be tailored to meet an unbelievable variety of specifications and because suppliers are constantly striving to provide the most suitable resin for each type of application. The severe competitive situation results in each producer claiming that he has a product best fitted for the job. And processors have learned by now that even though one supplier's resin may have the same density and melt index as another's, there can be a difference in the way they run through the machines.

Unfortunately, the processor or prospective end user isn't always sure just how to define what he wants. A molder, for example, may



Soda fountain jars, produced by Michigan Molded Products, Inc., Grand Haven, Mich., using high-density polyethylene, economically replace procelain and stainless steel jars in standard fountain equipment. They are unbreakable and stainproof; have been approved by the National Sanitation Foundation and the FDA. (Photo, Hercules Powder Co.)

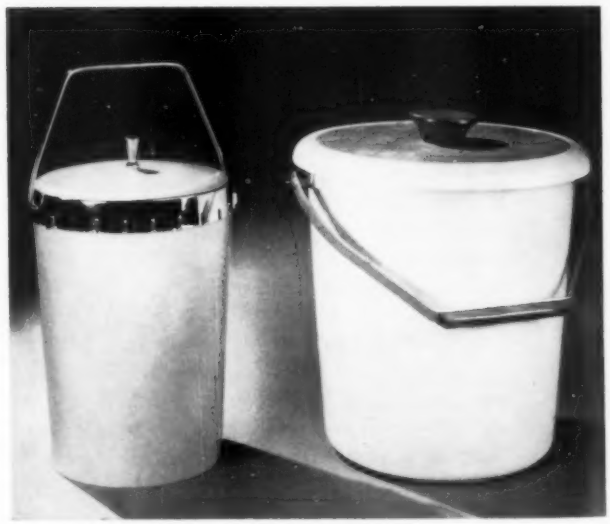
find that a film grade resin meets his particular need better than a molding grade resin. Thus a processor or user must rely heavily upon the recommendation of his favorite supplier or conduct a series of tests that are both expensive and time consuming. Most processors shy away from the latter because competition is so vicious that there is no margin of profit left for experimentation. Some try to meet the situation by blending, by using more off-grade material, by speeding up production, and by other cost-cutting operations that result in inferior products.

One producer's analysis of the situation goes something like this: "A man-made material is inherently influenced by human limitations and reflects quality from the worst to the best. One manufacturer can do likewise with polyethylene, according to his skill, and make either a good or a bad product and all the variations in between. Consequently, the purchaser must learn to protect himself and buy according to his need. If he insists on bargaining for price rather than performance, he is likely to come up with an inferior product.

"Of course, the industry needs a market for off-grade material and there are markets where it is satisfactory, but all products made from off-grade material should be properly labeled as is done in the textile and meat industries. If not, it is possible that the Government may step in and demand proper labeling of the end product, as has been done in the industries just mentioned. Labeling also helps to prevent use of a product for purposes that it was not intended for and it should be pointed out that a product which fails in misuse gives polyethylene as much of a black eye as one that fails in normal use."

Vast variety of formulations

The confusion growing out of the industry's capability to produce and use such a vast variety of formulations has been gaining headway



Beautiful colors of low-density polyethylene are combined with plated or anodized metal and polished wood to produce "big-ticket" items, such as these handsome ice buckets by Plas-Tex Corp., Los Angeles, Calif. (Photo, U. S. Industrial Chemicals Co.)

since 1953 when most of the resin used had a density of from 0.914 to 0.918. Today densities go all the way up to 0.960 and the confusion is compounded by the fact that housewares, bottles, film, and other products may be made from various densities over this entire range, depending upon the properties sought in the end product.

Generally speaking, the industry thinks of high-pressure-processed polyethylene (conventional type) as low-density and low-pressure-processed material as high-density or linear. But high-pressure producers are on the way toward manufacturing resins up to 0.940 density and low-pressure producers are coming down the scale from their original 0.960 and 0.950 to perhaps under 0.940. This may be done by blending resins of high- and low-density, by copolymerization, or by changes in manufacturing procedure.

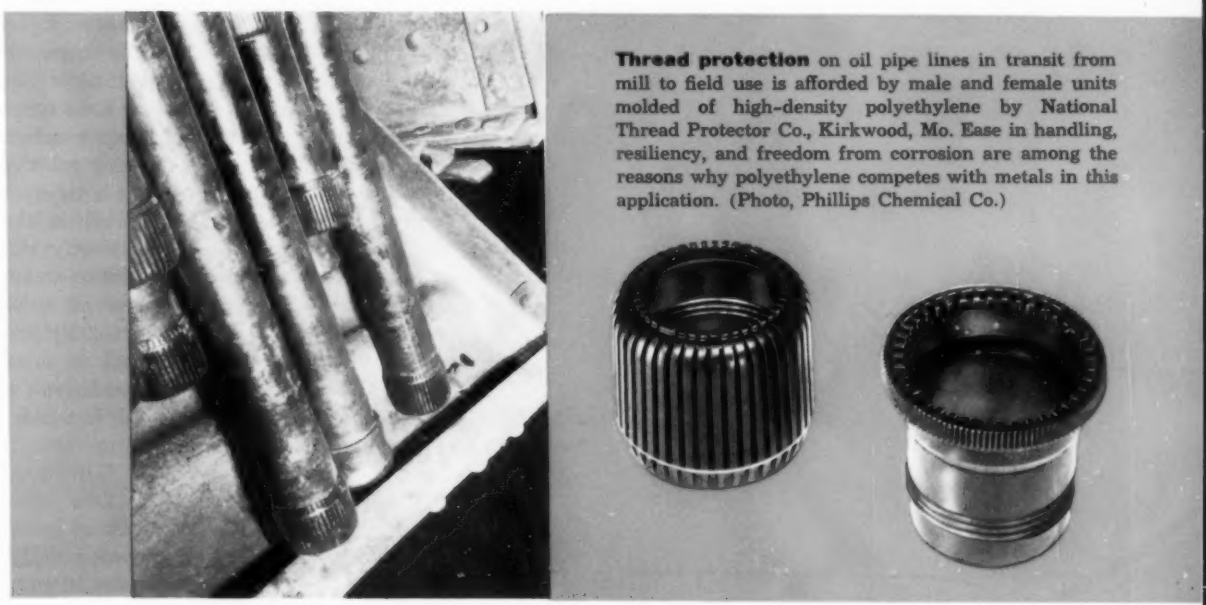
An attempt to clarify nomenclature on densities is being made by A.S.T.M. and the Manufacturing Chemists' Association, which suggest that resins of 0.925 and under be classified as low density; between 0.925 and 0.940 as medium density; and between 0.940 and 0.965 as high density. But why the range for medium density should begin at 0.925 instead of 0.930 is puzzling because the price increase for medium density material begins at 0.930. This is the point where producers say cost of production begins to increase because yield is less. Along this same line, one producer states that property changes in the resin are evident with every difference of 3 in the last digit; that is, 0.930 would show considerable difference over 0.927.

There are several producers who insist that "linear" polyethylene is a better name for low-pressure-processed material because it describes the type of molecule and would eliminate confusion that may arise if a resin of the same density, say 0.940, should be produced by both high- and low-pressure process and would accordingly have different properties. American Agile Corp., Bedford, Ohio, names its finished products "branched" and "unbranched." These names indicate the difference between the molecular structures of high- and low-pressure processed materials; the former is branched like an untrimmed tree limb and the latter's structure is like trimmed limbs stacked closely together. The implication, of course, is that each has different properties.

Medium density the latest

Medium-density material has become prominent only in the past two years and mostly in the film field where 0.926 to 0.929 density material is used for garment bags and wrapping soft goods. When density is 0.930 or more, the resin costs 37 to 42¢ lb. in contrast to 35¢ for lower density resins.

Although medium-density resin of the 0.930 type and over is sold only in small volume



Thread protection on oil pipe lines in transit from mill to field use is afforded by male and female units molded of high-density polyethylene by National Thread Protector Co., Kirkwood, Mo. Ease in handling, resiliency, and freedom from corrosion are among the reasons why polyethylene competes with metals in this application. (Photo, Phillips Chemical Co.)

today, there are analysts who predict that more than half of all the polyethylene sold in the middle 1960's will be in the medium-density range and that it will be made by both the high- and low-pressure processes.

The high-density or linear resins now ranging from 0.945 to 0.960 are the well-known low-pressure-process resins and sell for 43¢/lb.

The important points to know about density are that as density goes up, so does stiffness, surface hardness, temperature response (decomposition rate), and price; as density increases, the material also becomes less permeable to gases and vapors. On the other hand, higher density generally means that the resin is a bit more difficult to process, will usually have less impact strength, and is more subject to environmental stress cracking. By impact is meant resistance to a sharp, quick blow like that of dropping a potato into a sack. In other words, lower-density polyethylenes are tougher.

All of these things, of course, are relative and do not mean, for example, that a tumbler molded from higher-density resin is brittle like polystyrene, but they help explain why different densities are suggested for different applications. After all, these resins are all made from ethylene and have a broad similarity just like various kinds of wood. But oak is more suitable for flooring than pine. Polyethylene is in a similar category—it's all useful, but judgment is required to use it properly.

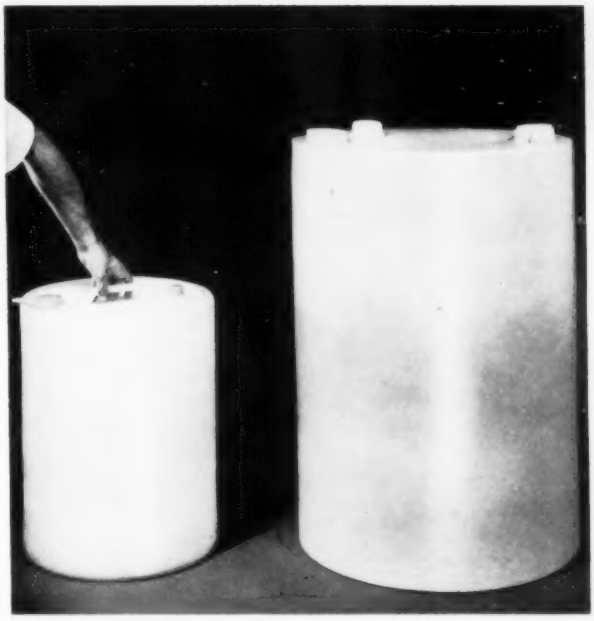
Chain saw motor shield (upper left), molded of brightly colored high-density polyethylene, is low in cost, lightweight, has necessary strength for the job, will not dent or shatter in rough use. Defroster duct for automobile use (right), made of same material, is economical to produce and install, is not affected by temperature changes. (Photo, Koppers Co.)

Doll bodies blow molded of a blend of low- and high-density polyethylenes by Plastic Molded Arts Corp., Long Island City, N. Y., promise to revolutionize doll manufacturing. In some doll sizes, savings over conventional materials and processes amount to 25% or more. (Photo, Celanese Corp. of America)

Melt index is also important

After density, the next most common measurement for polyethylene is melt index (MI). This is, in effect, a measure of viscosity; it indi-

Bottle carrier, molded of medium-density polyethylene, can be sterilized for reuse, is 10 times as economical for the bottlers' use as the paper cartons it replaces. Made by Dura-Pak, Inc., Dallas, Texas, it is also more attractive and handier for the consumer. (Photo, Spencer Chemical Co.)



Natural use for polyethylene is the field of transportation of chemicals. Unit at left was made in Europe, while the 55-gal. tank at right is made by the Delaware Barrel & Drum Co. Manufacturer is currently producing similar containers in sizes up to 265-gal. capacity. And even larger ones are planned

cates the number of grams of material that will flow through a standard orifice at a standard temperature and pressure. It is a test for identification only and not a performance prediction since the test temperature and pressure are well below normal processing figures. Furthermore, it is unwise to compare the MI of resin produced by *A* with that produced by *B* or any other producer since each different manufacturer's resin will vary enough to make quite a difference in molding or extrusion operations.

The principal purpose of the MI designation seems to be that each producer can use it to indicate the comparative flow properties of his various resins. For example, in high-pressure-processed materials, a resin with a low MI is more difficult to work in the machine but gives what seems like a harder surface. Thus, an 0.6 MI might be used for wire coating; a 2.0 to 5.0 MI for film; and an 18.0 or 20.0 MI for molding large pieces. A high MI generally signifies an easier flow and a low MI signifies a tougher material when low-density resins are involved. The tendency to stress-crack goes up as the MI increases.

Melt index as a measure of flow for low-pressure-processed, high-density resins is more complex. Producers now have new high-density resins with an MI of 6.0 to 9.0 which are suggested for film, coating and some types of molding that require a fast flow; 1.5 and 3.0 MI material is recommended for (*To page* 186)

WHO MAKES WHAT POLYETHYLENE

Producer	High-pressure process 0.912 to 0.935 density	Ziegler process 0.945 to 0.955 density	Phillips process 0.955 to 0.960 density
Bakelite	•	•	•
Du Pont	•		
Texas Eastman	•		
Spencer Chemical	•		
U. S. I.	•		
Phillips			•
Grace Chemical			•
Celanese			•
Koppers	•	•	
Hercules		•	
Dow	•	•	
Monsanto	•		
Allied*			

*Low pressure by their own method.

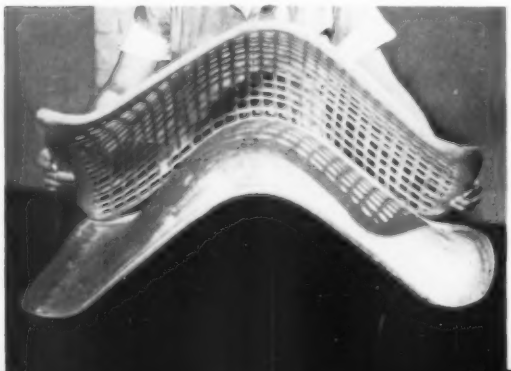
NEW CHAIR CONCEPT

Reinforced plastics molding method produces one-piece back and seat unit that is flexible for greater seating comfort

Flexible reinforced plastics occasional chair has one-piece molded seat and back; legs and arms of wrought iron. It is weather-resistant and will not collect water

Trimming of polyester-saturated fibrous glass roving is done after special machine lays the strips down on the mold. At left, mold with complete lay-up is placed in curing oven

Finished chair section is lifted from the mold after curing. The open design permits the chair to "give" slightly for more comfortable seating. (Photos, U. S. Rubber)



A different approach to reinforced plastics molding has resulted in a new type of occasional chair for indoor or outdoor use. Of openwork design, the chair will not collect water and, in use, it "gives" slightly to mold itself to body contours for more comfortable seating.

The lightweight chair, with wrought iron base and legs, resembles cane furniture. Though it has a woven appearance with square spaces between horizontal and longitudinal plastic strips, the contour seat and back is actually a one-piece molding and the surface of the chair is smooth.

In the novel manufacturing technique, spaced strips of braided fibrous glass roving, saturated with flexible polyester resin, form the body of the chair, which is trimmed with a molded-in edge of special roving tape. The reinforced plastics molding is produced in four colors, while the wrought iron base and legs are available in 14 colors. Retail prices start at about $45.

Credits: Seat and back molded by Winx Products, Inc., New Hyde Park, N. Y., for Molla, Inc., Westbury, N. Y. Vibrin polyester resin supplied by Naugatuck Chemical Div., U. S. Rubber Co., fibrous glass roving tape edge developed and supplied by Hess Goldsmith & Co., Inc., New York, N. Y.

Fragile electronic tubes travel safer,

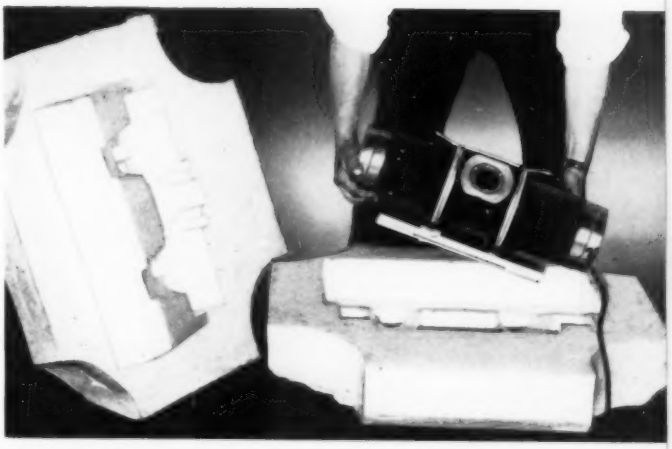
in a lighter and smaller package, when

Encased in urethane foam

Molded polyether urethane foam is being used by Standard Plastics, Inc., Allentown, Pa., for cushion packaging of such products as delicate radar and X-ray tubes. Snugly encased in the foam, these irregular shaped and difficult-to-package tubes can be shipped anywhere with complete safety; and, equally important, with cost, weight, and cubage savings over other packaging methods.

In the case of a delicate General Electric magnetron power tube, the foam package, inside a corrugated case, gives weight savings of 157 lb. (75 lb. against 232 lb.) over a wood packing case with rubberized hair for cushioning. Because of the excellent energy absorbing characteristics of the 2½ lb./cu. ft. density foam, cubage was cut to ⅛ that of the former package. In this particular case, packaging costs were also cut by 30 percent.

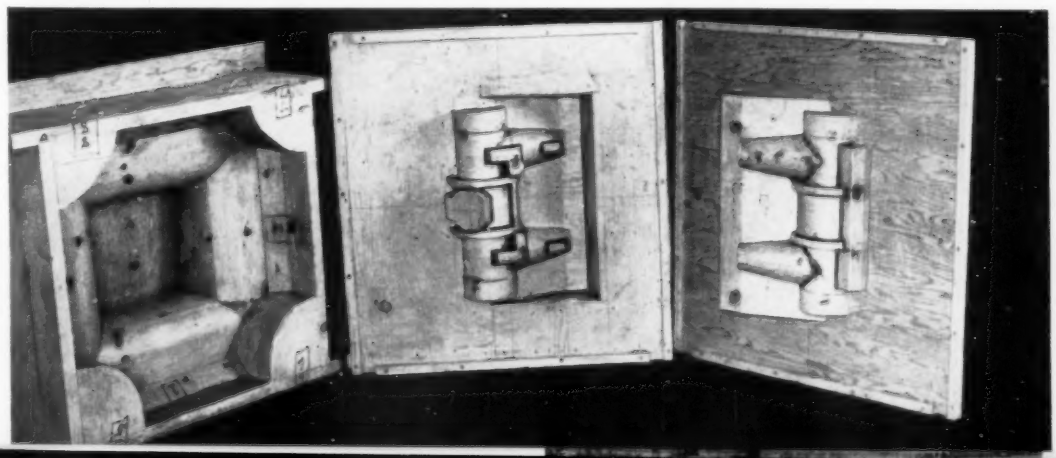
The foam packages manufactured by Standard Plastics are all individually molded to conform to the shape of the object to be packaged. A wood model of the object to be packaged is split in half and the halves used in two separate molds. The urethane foam is introduced into the mold from a mixing head. Then a cover is applied and the foam swells to fill the cavity. A 2-hr. postcure at 250° F. decreases compression set and odor.



Foam package for X-ray tube consists of two contour-molded pieces of foam which weigh 8 lb. each. Package may be opened at will without damage to the foam

In service, the polyether urethane foam can withstand severe temperature conditions, from —50 to 160° F., without losing its resiliency. This is an important consideration, especially when the electronic tubes are sold to the military and shipped anywhere from the Arctic to the tropics.—End

Molds for X-ray tube package were made from wood model of tube. Two male molds at right duplicate each side of tube, and are used with female mold at left to form package halves. Foam is introduced through top of female mold. (Photos, Standard Plastics)



Take your choice of

COATING METHODS Part 2

*By George L. Booth**

The first part of this article, published in the September issue of MODERN PLASTICS, *pointed out the importance of web coating to the plastics industry. It discussed and illustrated roll coaters, including reverse-roll, kiss, nip, gravure, bead, and dip coaters.*

This, the concluding part, covers post-metering and/or smoothing devices, spray coaters, extrusion coaters, cast coaters, and calender coaters. It also includes a chart which shows how to approach the selection of a coating method to reach the desired end result.

Various types of both flexible and rigid blade knife coaters, round bars, wire-wound bars, bull noses, air doctors, and brushes fall into the category of post-metering and/or smoothing devices. The coating can be applied ahead of the metering or smoothing device by roll application or by pumping or spraying onto the sheet.

Knife-over-roll coater. Fig. 12 shows a knife-over-roll coater capable of applying a relatively thin coating of very high viscosity to the web. It is a simple method of coating, but variations in caliper of the web will affect the uniformity of coating. Tension, knife angle, and contour are primary coating-weight controls. Open-mesh fabric is difficult to process on this type of machine because of strike-through.

Floating-knife coater. The floating-knife coater shown in Fig. 13 is used extensively for coating fabrics. It has the advantage of being able to process an open fabric since strike-through will not adversely effect the operation. Because this set-up can apply no more than two to three mils of coating, several passes are necessary to build up a relatively heavy coating. Web tension is a very important factor.

Blanket-knife coater. The knife-over-blanket coater (see Fig. 14) is somewhat of a compromise between the knife-over-roll and the unsupported knife. It is used primarily on stretchy materials because the blanket tends to carry the web under the knife without undue stretching. Also, a certain amount of backing is given to the web although not as much as in a knife-over-roll coater. This knife coater, like the previous two, can handle (*To page* 97)

*Application Engineer, Dilts Div., The Black-Clawson Co., Inc., Fulton, N. Y.

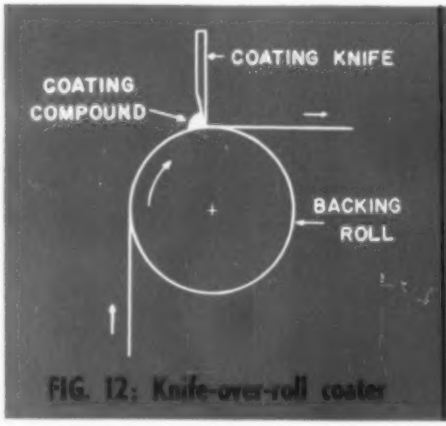


FIG. 12: Knife-over-roll coater

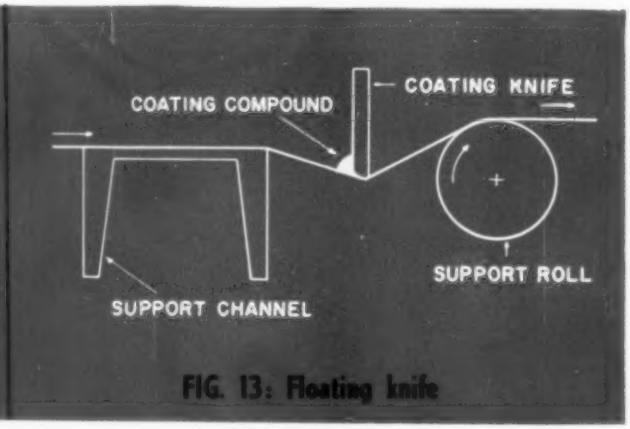


FIG. 13: Floating knife

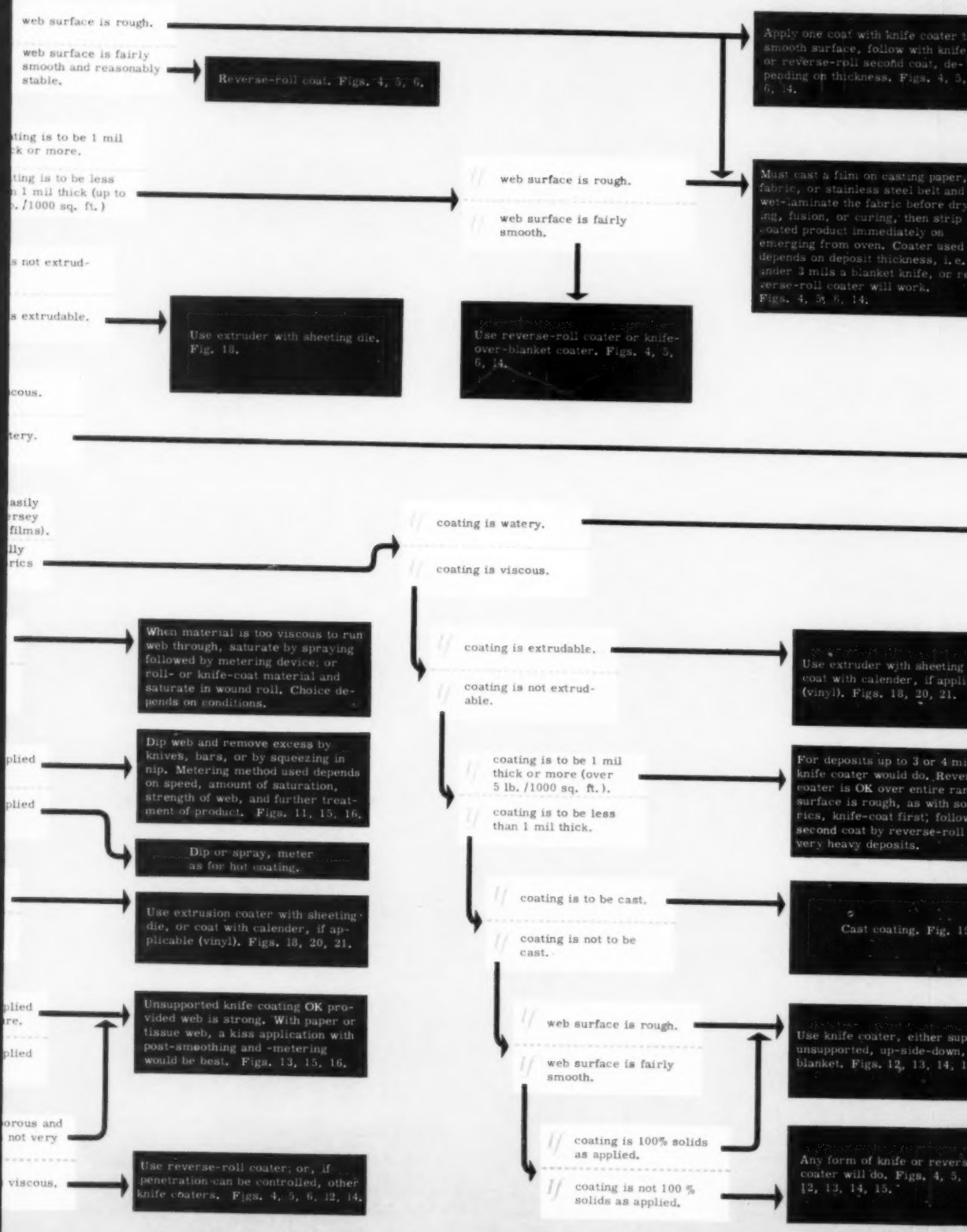
A GUIDE TO CHOOSING THE RIGH

INSTRUCTIONS: Enter chart at arrow, below left, and choose between successive alternatives on basis of characteristics of coating, web, and process.

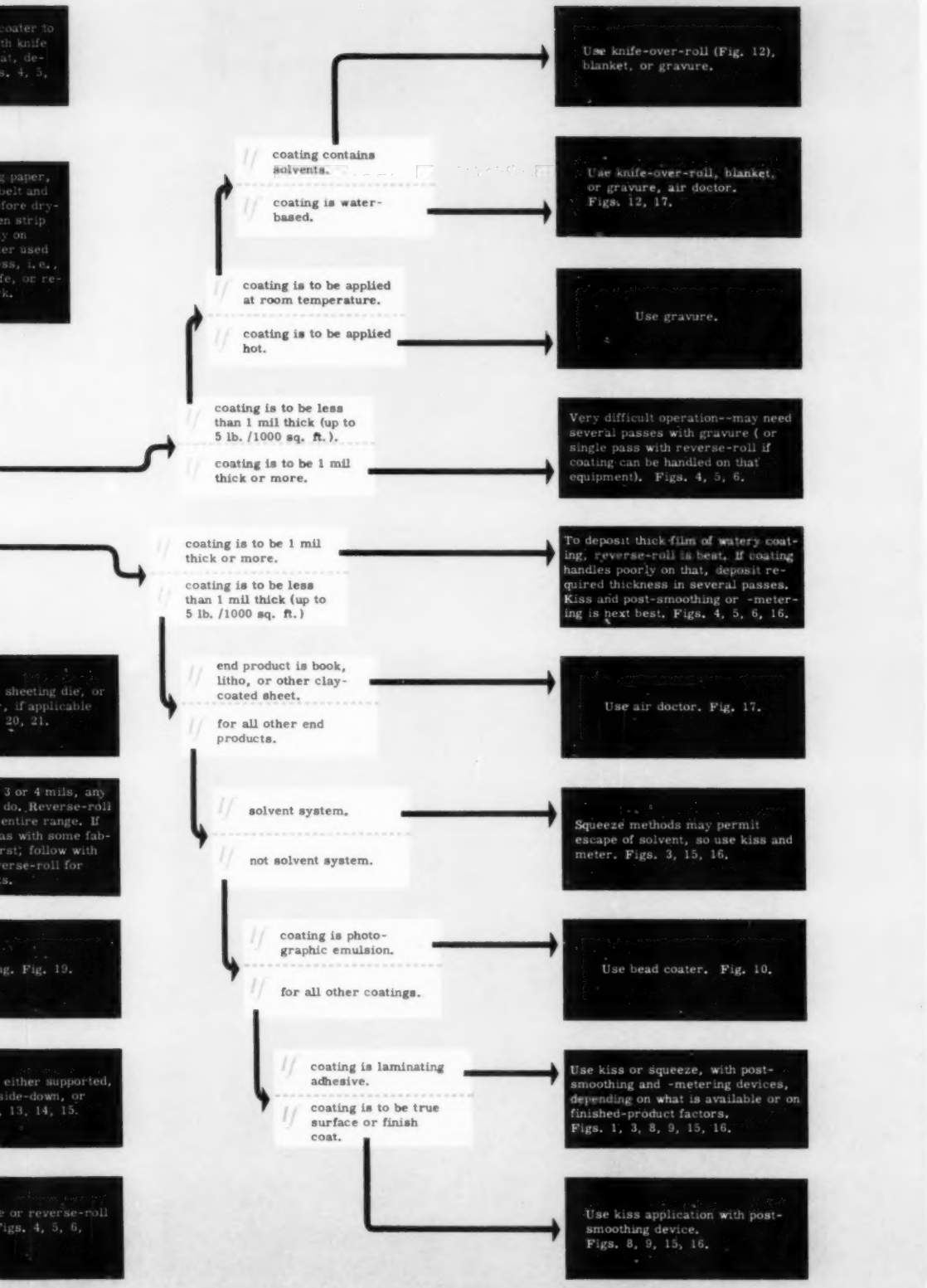
EXAMPLE: It is desired to coat a kraft paper with polyethylene. At first box, since web is closed, go to right; since this is to be a surface coating, continue to next right; web is dimensionally stable so continue to right; coating is viscous and extrudable, so use extruder with sheeting die or coat with calender.

- web is closed.
- web is porous (prone to strike through).
- surface coating.
- saturating or impregnating process.
- saturating or impregnating process.
- surface coating.
- web is stretchy, easily deformed, etc. (jersey knits and plastics films).
- web is dimensionally stable (certain fabrics and papers).
- coating is viscous.
- coating is watery.
- coating is not extrudable.
- coating is extrudable. → Use extruder with sheeting die. Fig. 18.
- coating is to be 1 mil thick or more.
- coating is to be less than 1 mil thick (up to 5 lb. /1000 sq. ft.)
- web surface is rough.
- web surface is fairly smooth and reasonably stable. → Reverse-roll coat. Figs. 4
- coating is viscous. → When material is too viscous to run web through, saturate by spraying followed by metering device; or roll- or knife-coat material and saturate in wound roll. Choice depends on conditions.
- coating is watery.
- coating is to be applied hot. → Dip web and remove excess by knives, bars, or by squeezing in nip. Metering method used depends on speed, amount of saturation, strength of web, and further treatment of product. Figs. 11, 15, 16.
- coating is to be applied cold. → Dip or spray, meter as for hot coating.
- coating is viscous.
- coating is watery.
- coating is to be applied hot. → Hot coating best applied with 1-, 2-, or 3-roll kiss followed by chilling to control depth. A heated post-metering or -smoothing device is recommended--knives not good for hot application except as post-metering devices.
- coating is to be applied at room temperature.
- coating is to be 1 mil thick or more. → With water-thin coating and porous web, must fill-coat the web first in order to deposit heavy coat of thin material. Need minimum of two passes, depending on final coat weight. Best is 1- or 2-roll kiss with no post-metering device, but preferably with post-smoothing device. Figs. 1, 3.
- coating is to be less than 1 mil thick (up to 5 lb. /1000 sq. ft.).
- coating is to be followed by lamination. → Use 1- or 2-roll kiss with any combination of speed and roll rotational direction to give adequate coverage. Figs. 1, 3.
- coating is to be true surface or finish coat. → Use 1-, 2-, or 3-roll kiss and follow with thin knife, smoothing roll, or rod. Fig. 16.
- coating viscosity is 100,000 cp. or more. → Use extrusion coater with sheeting die, or coat with calender, if applicable (vinyl). Figs. 18, 20, 21.
- coating viscosity is below 100,000 cp.
- coating is to be applied at room temperature. → Unsupported knife coating OK provided web is strong. With paper or tissue web, a kiss application with post-smoothing and -metering would be best. Figs. 13, 15, 16.
- coating is to be applied hot.
- web is very porous and hot coating is not very viscous.
- hot coating is viscous. → Use reverse-roll coater; or, if penetration can be controlled, other knife coaters. Figs. 4, 5, 6, 12, 14.

THE RIGHT COATING MI


web surface is rough.
web surface is fairly smooth and reasonably stable.
Reverse-roll coat. Figs. 4, 5, 6,
Apply one coat with knife coater
smooth surface, follow with knife
or reverse-roll second coat, de-
pending on thickness. Figs. 4, 5,
6, 14.
ting is to be 1 mil
k or more.
ting is to be less
1 mil thick (up to
. /1000 sq. ft.)
web surface is rough.
web surface is fairly smooth.
Must cast a film on casting paper,
fabric, or stainless steel belt and
wet-laminate the fabric before dry
ing, fusion, or curing, then strip
coated product immediately on
emerging from oven. Coater used
depends on deposit thickness, i.e.
under 3 mils a blanket knife, or re
verse-roll coater will work.
Figs. 4, 5, 6, 14.
s not extrud-
s extrudable.
Use extruder with sheeting die.
Fig. 18.
Use reverse-roll coater or knife-
over-blanket coater. Figs. 4, 5,
6, 14.
cous.
tery.
asily
rsey
films).
lly
rics
coating is watery.
coating is viscous.
When material is too viscous to run
web through, saturate by spraying
followed by metering device; or
roll- or knife-coat material and
saturate in wound roll. Choice de-
pends on conditions.
coating is extrudable.
Use extruder with sheeting
coat with calender, if appli
(vinyl). Figs. 18, 20, 21.
coating is not extrud-
able.
plied
Dip web and remove excess by
knives, bars, or by squeezing in
nip. Metering method used depends
on speed, amount of saturation,
strength of web, and further treat-
ment of product. Figs. 11, 15, 16.
coating is to be 1 mil
thick or more (over
5 lb. /1000 sq. ft.).
For deposits up to 3 or 4 mi
knife coater would do. Revel
coater is OK over entire ran
surface is rough, as with so
rics, knife-coat first; follow
second coat by reverse-roll
very heavy deposits.
plied
Dip or spray, meter
as for hot coating.
coating is to be less
than 1 mil thick.
Use extrusion coater with sheeting
die, or coat with calender, if ap-
plicable (vinyl). Figs. 18, 20, 21.
coating is to be cast.
Cast coating. Fig. 1
coating is not to be
cast.
plied
re.
Unsupported knife coating OK pro-
vided web is strong. With paper or
tissue web, a kiss application with
post-smoothing and -metering
would be best. Figs. 13, 15, 16.
web surface is rough.
Use knife coater, either sup
unsupported, up-side-down,
blanket. Figs. 12, 13, 14, 1
web surface is fairly
smooth.
plied
orous and
not very
coating is 100% solids
as applied.
Any form of knife or revers
coater will do. Figs. 4, 5,
12, 13, 14, 15.
viscous.
Use reverse-roll coater; or, if
penetration can be controlled, other
knife coaters. Figs. 4, 5, 6, 12, 14.
coating is not 100 %
solids as applied.

METHOD


coater to
th knife
at, de-
s. 4, 5,
g paper,
belt and
fore dry-
en strip
y on
er used
ss, i.e.,
fe, or re-
k.
coating contains solvents.
coating is water-based.
Use knife-over-roll (Fig. 12), blanket, or gravure.
Use knife-over-roll, blanket, or gravure, air doctor. Figs. 12, 17.
coating is to be applied at room temperature.
coating is to be applied hot.
Use gravure.
coating is to be less than 1 mil thick (up to 5 lb. /1000 sq. ft.).
coating is to be 1 mil thick or more.
Very difficult operation--may need several passes with gravure (or single pass with reverse-roll if coating can be handled on that equipment). Figs. 4, 5, 6.
coating is to be 1 mil thick or more.
coating is to be less than 1 mil thick (up to 5 lb. /1000 sq. ft.)
To deposit thick film of watery coating, reverse-roll is best. If coating handles poorly on that, deposit required thickness in several passes. Kiss and post-smoothing or -metering is next best. Figs. 4, 5, 6, 16.
sheeting die, or
, if applicable
20, 21.
end product is book, litho, or other clay-coated sheet.
for all other end products.
Use air doctor. Fig. 17.
3 or 4 mils, any
do. Reverse-roll
entire range. If
as with some fab-
rst; follow with
erse-roll for
s.
solvent system.
not solvent system.
Squeeze methods may permit escape of solvent, so use kiss and meter. Figs. 3, 15, 16.
g. Fig. 19.
coating is photographic emulsion.
for all other coatings.
Use bead coater. Fig. 10.
either supported,
side-down, or
13, 14, 15.
coating is laminating adhesive.
coating is to be true surface or finish coat.
Use kiss or squeeze, with post-smoothing and -metering devices, depending on what is available or on finished-product factors. Figs. 1, 3, 8, 9, 15, 16.
e or reverse-roll
igs. 4, 5, 6,
Use kiss application with post-smoothing device. Figs. 8, 9, 15, 16.

high-viscosity coating materials but it has the same disadvantages of the others: the coatings are prone to streaking and the coating deposit per pass is relatively light. An open material cannot be processed on this type of coater because of strike-through.

Inverted-knife coater. The inverted-knife coater shown in Fig. 15 can be likened to the unsupported-knife coater except that it will not handle quite as high viscosities as the unsupported knife because the coating is carried to the fabric by a roll.

Spanishing coater. Pyroxylin coatings were applied by a knife-coating operation called Spanishing, that used a blade only 10 to 20 mils thick. This type of coating was more useful for decorative effects on embossed goods than for functional properties. In this operation the knife blade simply removed the excess material from the goods.

Smoothing bars. In most kiss-coating applications, the coater is followed by a smoothing bar of the smallest diameter commensurate with the width of the machine. The primary purpose of this bar is to remove any striation or pattern from the coating by its smoothing action, although in some cases it can be employed as a metering device.

Wire-wound bar coaters. A wire-wound bar coater is shown in Fig. 16. The coating is applied by one or two rolls which can rotate in either direction. The speed of the applicator roll can be varied in relation to the web speed in order to control the amount of coating being applied.

The diameter of the wire wound on the bar determines to a great extent the amount of coating applied. This coater is used primarily in the carbon coating industry and on hot-melt applications.

Bull noses. Bull noses are a special design of knife, usually a round shaft that has an approximately 90° sector milled out of it. Application of this knife is somewhat limited and will be found to some extent in heavily loaded mineral dispersion systems.

Air doctors. Air blade applications are broken down into two categories: the air brush which simply smooths the coating and the air doctor which does the same thing but also acts as a positive metering device.

An air doctor (see Fig. 17) impinges on the work at an angle of 60 to 45° with the work surface. The blast of air actually drives the coating downward and removes it in spray form, at the same time leveling the remaining coating. With the air brush, the correct amount of coating has to be applied rather uniformly; with the true air doctor, more than enough coating material is applied and the excess removed.

The air doctor has been operated at speeds over 1000 ft./minute. Coat weight control is primarily a function of air pressure. Secondarily, coat weight control is maintained by the speed of roll *A* (Fig. 17) and the lineal speed

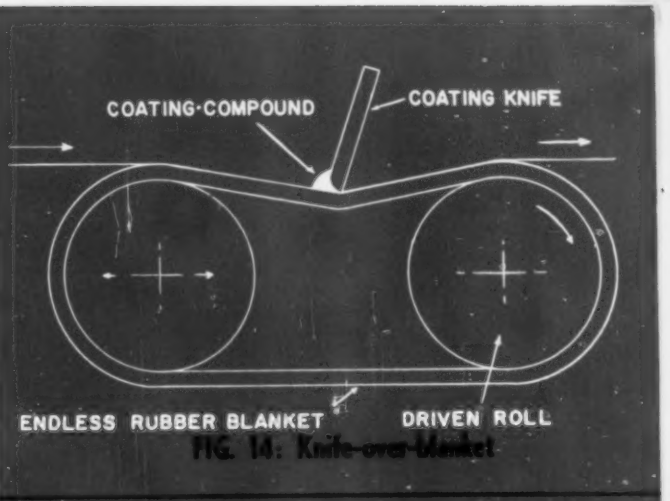


FIG. 14: Knife-over-Blanket

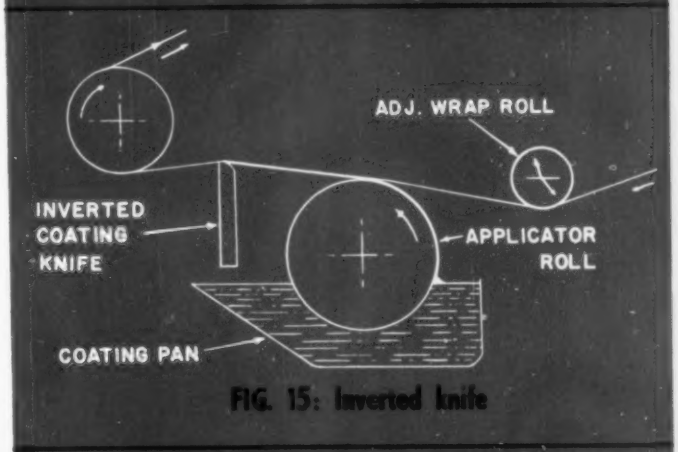


FIG. 15: Inverted Knife

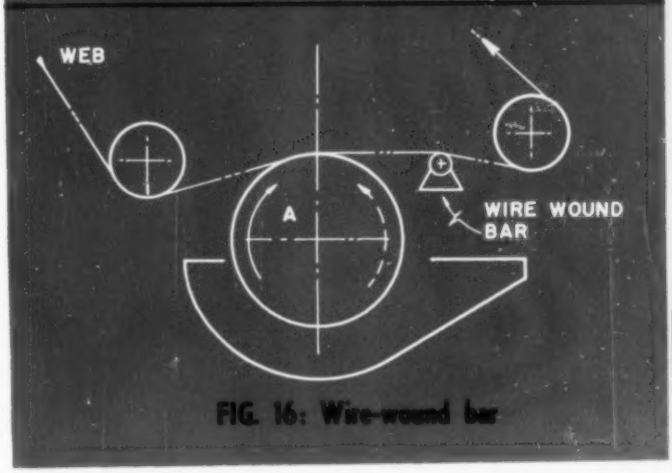


FIG. 16: Wire-wound bar

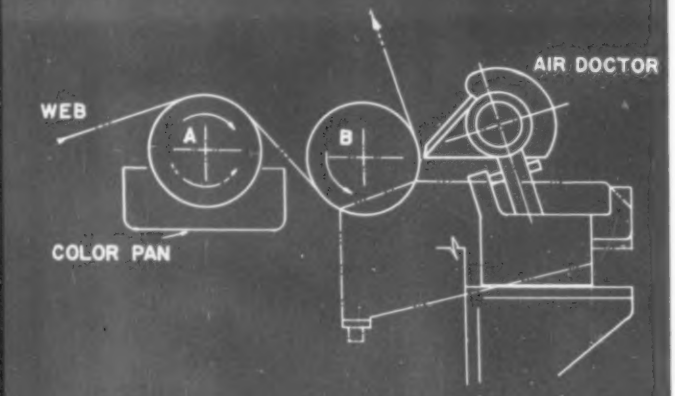


FIG. 17: Air-doctor coater

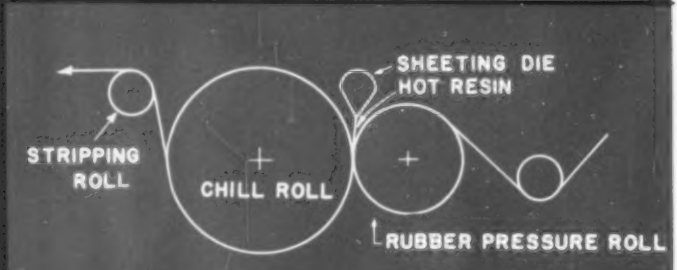


FIG. 18: Hot extrusion coater

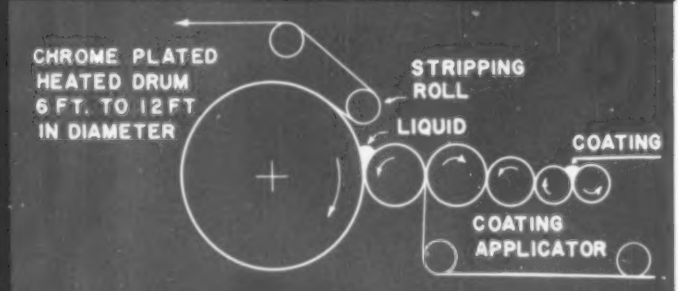


FIG. 19: Cast coater

of the web. Note that this roll can rotate in either direction. However, for most high-speed operations, it rotates in the direction of web travel and at 5 to 30% of web speed.

Products obtained from this machine are primarily printing-grade papers but it can also be used for functional coatings such as barrier-forming latex emulsions, vinyl acetates, and color or wash coats on paper. One of the big advantages of this coater is that it coats contours. Thus, highly embossed leatherette, for example, can be coated uniformly and without loss of pattern definition.

With this type of coater, solids content of the coating can run anywhere from almost zero up to approximately 50 percent. The viscosity range seems to be from 15 to 1000 cp., dependent on the rheology of the coating and the speed of operation. Coat weights can run anywhere from almost zero up to 20 lb./3000 square feet.

The air doctor has generally found limited use for solvent coatings, although the solids content of the coating must be closely supervised because the solvent is lost in the spray-off from the air doctor.

Brush coaters. Many types of brush coaters are in use today, primarily for clay-coating operations. This coating method has limited application because of downtime for cleaning, slow speed of operation, and need for frequent brush replacement.

Spray coaters used for web coating applications are of very limited interest and use because of large wastage and non-uniformity of coating.

Extrusion coaters

Extrusion coaters handle primarily polyethylene, although some extrusion coating is done with the vinyls and polystyrene. Such coaters (see Fig. 18) are ordinarily rated in lb./hr., with the actual film thickness determined by the web speed.

In this process, the hot melt from the sheeting die of the extruder simultaneously comes in contact with a chill roll on one side and the web and pressure roll on the other. Lamination takes place under moderate pressure and the resin coating takes on the mirror finish of the roll surface.

Ethyl cellulose is occasionally extruded as a paste made up of the resin plus solvent. (Today this is not often done because other methods of applying ethyl cellulose coatings have become increasingly more economical than has the use of paste extrusion.)

The ethyl cellulose is formed into a gelatinous mass with a small quantity of solvent, then dispersed in a plasticizer. The organosol is extruded onto the moving web and passed through an air dryer to remove the solvent. The product resulting from this operation has a glossy finish comparable to that obtained in cast coatings.

Cast coaters

The field of cast coating is somewhat restricted by patents in force. The product obtained can have a very high gloss; its surface

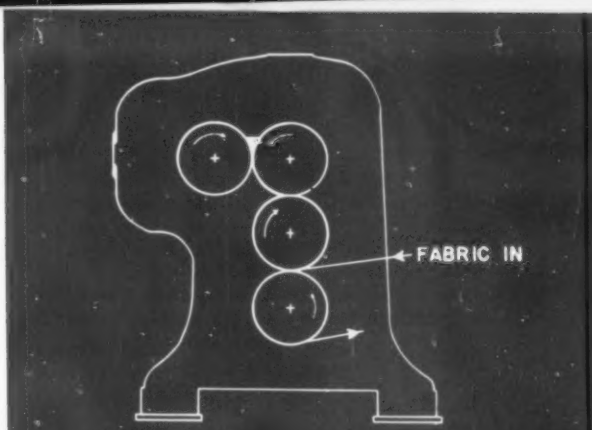


FIG. 20: Inverted "L" calender

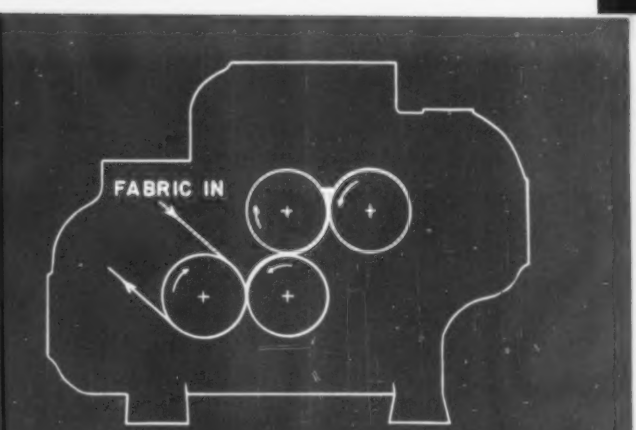


FIG. 21: "Z" type calender

is a faithful image of the casting drum. (See Fig. 19.)

The coating is applied to the web as it meets the casting drum and the coated product cannot be stripped from the drum until it has completely dried. Drum surface temperature usually does not exceed 200° F. and the speed of operation is directly related to that of the drum diameter.

Calender coaters

Calender coating finds its biggest use in the application of high viscosity paste-type vinyls to pre-filled or close-woven fabrics. Two calender systems are shown in Figs. 20 and 21. Calendered coating thickness cannot ordinarily go below 5 mils because of the milling of the coating on the fabric.

In this coating method, the fabric is usually pre-coated not only to fill it but also to obtain a better bond to the vinyl coating. The fabric is almost always heated prior to entry into the calender and great care is taken not to wrinkle it. Such stretchy fabrics as jersey knits are difficult to process on a calender since a reasonably high tension has to be maintained and this causes necking down of the width.

Choosing a method

To select the coating method for a given task, the following information is needed to obtain the best results:

1) Type of web on which the coating is to be applied.

2) The coat weight that is to be applied per unit area.

3) The solids content and rheological characteristics of the coating material.

4) Whether coating is to be applied hot or cold, in solvent or dispersion.

5) End use of product.

Armed with such information, it is possible to start to select which of several methods will probably apply to the particular problem. The selection can then be narrowed down further by production required per day, width of available machine, and other sundry items which also influence the choice of one method or another. A chart giving various steps which can be used in selection of a method will be found opposite p. 90, together with condensed instructions for its use. The following example describes the use of the chart in considerably more detail:

Assume that an 8-mil organosol coating with a viscosity of about 12,000 cp. is to be applied to a closed, presized, sateen fabric.

Entering the chart at the first box, there is a choice: the web is porous, or the web is closed. Since ours is closed, we go on to the next choice: saturation (impregnating) or surface coating. Ours is to be a surface coating on a dimensionally stable web, so, passing through the next box, we follow the arrow (to the right), where our next choice is: viscous or watery; since this organosol is viscous, we go on to the next box: extrudable or not extrudable. Since this coating is not extrudable, we follow the (lower) line to the thickness choice. Since we want "greater than 1 mil," we go to the final box where we find that we can use any practical form of knife coater for coatings up to 4 mils; over that amount we should use a reverse-roll coater. However, in some cases where the web surface is rough, it may be necessary to use a knife pre-coat and follow with a second coat on a reverse-roll coater.

This chart gives a practical start to the selection of a coating method. It is not perfect or foolproof. A certain amount of discretion should be applied in its use, but it should prove to be a valuable tool to all those concerned with the application of coatings to continuous webs.—End

High-density polyethylene having a low melt index is used for the 1½-gal. water container of this new lightweight vaporizer-humidifier. Attractively styled injection molded unit in turquoise eliminates breakage and shipping problems associated with glass jar models. Integrally molded handles make it easy to lift and to carry the appliance. (Photo, Spencer Chemical Co.)

Vaporizer in HD polyethylene

Advantages of light weight and virtual unbreakability insure consumer acceptance despite a retail price higher than glass units

An automatic electric vaporizer-humidifier recently introduced by Hankscraft Co., Reedsburg, Wis., confirms the suitability of injection molded high-density polyethylene for consumer products involving elevated temperatures.

In addition to the high-density polyethylene used in the attractively styled water container of the vaporizer, the unit includes two compression molded phenolic components. These parts, when assembled, comprise a steam tube, housing stainless steel electrodes; a steam chamber; and a domed, removable cap of the appliance. As water is converted into steam within this tubular assembly, the vapor discharges through an orifice in the cap, just above a polyethylene medicament cup which snaps into a well in the vaporizer cap. Unaffected by steam or by the medicaments used, the cup may be easily removed for cleaning.

The new high-density polyethylene vaporizer comes in an attractive integral turquoise color with hot-stamped gold trademark and is virtually unbreakable under normal conditions of use. Although it weighs only 3 lb., it has a generous 1½-gal capacity. Despite its retail price of $9.95, as compared with an earlier glass-jar model which sold for $6.95, the advantages of the polyethylene unit are so obvious that the producer has been hard pressed to keep up with orders.

Two-part body

The body of the new vaporizer is molded in two parts: the basic container, having a maximum diameter of 9½ in., and the cover. Selection of high-density polyethylene for this appliance was made only after extensive testing, in cooperation with the material supplier, to determine the proper formulation, melt index, and other variables. Problems included not only the high temperatures to which parts of the reservoir are subjected during operation, but particularly the effect of repeated on-and-off cycling. It was found that by using material having a low melt index, and incorporating a suitable additive, embrittlement due to temperature changes could be prevented.

An important consideration in the design of the vaporizer-humidifier was the achievement of a steam-tight bond between the basic container and its cover. The outer edge of the cover and the top edge of the base have a tight fitting tongue-and-groove joint and a special heat-sealing technique is used to obtain a positive seal. To this end, a length of flat Nichrome ribbon is inserted in the grooved edge of the cover before the two parts are snapped together. The container is then placed in an air operated press and the ribbon is heated by induced current from a 3 kw. induction welding machine. The work coil of the welder consists of a ⅛-in. square wire, hollow to permit water cooling, embedded in a piece of acrylic plastic. During the heat cycle of approximately 10 sec., the Nichrome wire melts the adjacent polyethylene surfaces, fusing them into a permanent assembly.

The phenolic material used in the cap and tube of the vaporizer is an impact-resistant grade, molded on a 300-ton compression press, using electronically heated preforms. A flange at the top of the tube seats against the inner surface of the cap, to which it is attached by three self-tapping screws. The metal electrodes are mounted beneath the domed cap by two bolts which pass through cored holes. The tops of these bolts comprise the terminals for the electric cord. The outside surface of the dome is finished in ivory enamel.

Credits: Container and cover molded by Richardson Co., Indianapolis, Ind., plant, using Poly-Eth Hi-D 1506, produced by Spencer Chemical Co., Kansas City, Mo. Medicament cups molded by Flambeau Plastics Corp., Baraboo, Wis., using same material. Phenolic parts for electrode tube and cap by Milwaukee Plastics, Inc., Milwaukee, Wis., using Bakelite BM 13080 black material. High frequency induction heating unit, Reeve Electronics, Inc., Chicago, Ill. Styling of vaporizer, Dave Chapman Industrial Design, Chicago, Ill.

Base and cover of the container have mating tongue-and-groove edges for tight fit. Length of Nichrome ribbon, laid in joint before parts are assembled, welds them permanently together when heated by induction

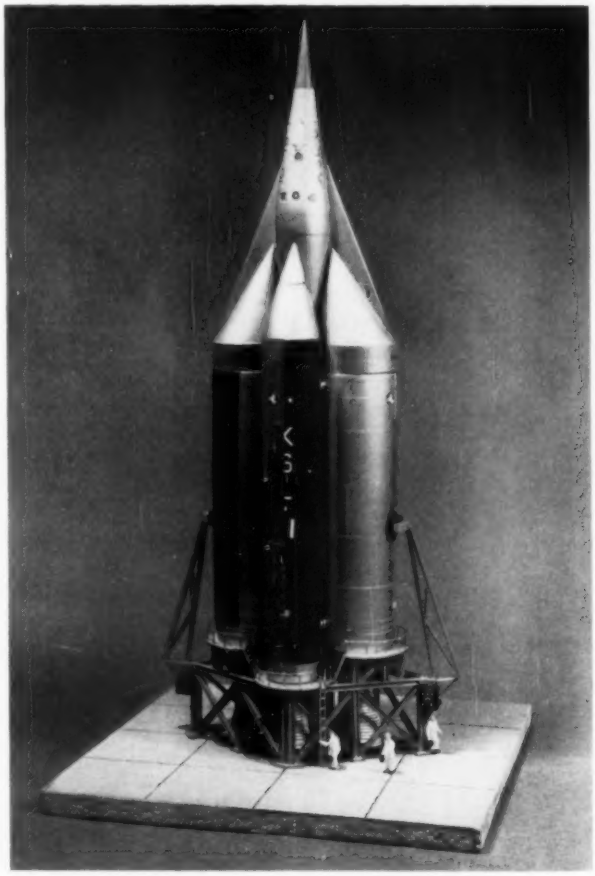
Electrode tube (left) and cap of vaporizer, molded of impact-resistant phenolic, are assembled with three self-tapping screws. Medicament cup (foreground) is molded of high-density polyethylene

To seal housing, container is placed in air-operated press in inverted position, bringing joint in contact with work coil embedded in piece of acrylic material. Current from induction welding machine, passing through work coil, causes Nichrome wire to heat and melt the material, forming permanent bond

Space-age toys

Fast design engineering, proper use of plastics, and speed of getting into production are keys to marketing in a field where news breaks change the picture rapidly

Manned rocket ship consists of three stages which may be separated to simulate any stage of space travel. The third stage has a cockpit hatch, which opens to reveal the figures of a 3-man crew and detailed control panel. The 14-in. model (shown complete below), also features directional-control nozzles and launching platform with ground crew. (Photos, Revell, Inc.)



When the first earth satellite was launched late last year, it opened a new marketing dimension for the U. S. toy industry. Makers of plastics model kits, particularly, blasted off to cash in on the new areas created by the dramatic scientific accomplishments.

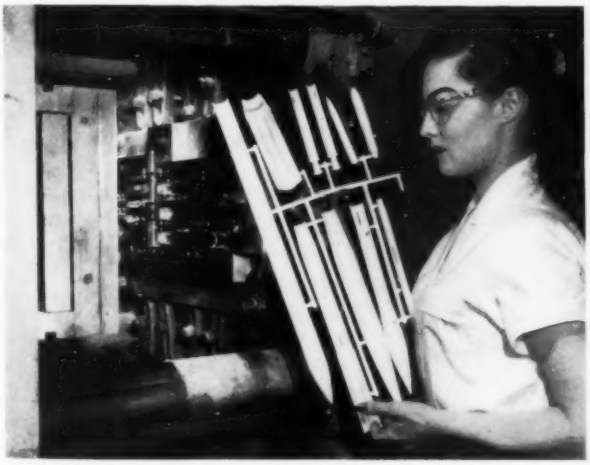
By March, when the annual Toy Fair opened in New York City, half a dozen of the kit manufacturers had at least prototype models of rockets, missiles, and space vehicles on display. Firms lucky enough to have "space" models already in production, like Hawk Model Co., Chicago, Ill., with its Atlas ICBM were happily riding the crest of the new wave of interest.

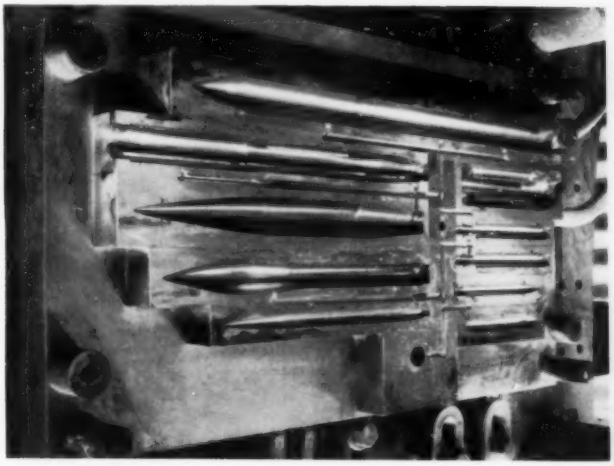
Though the space theme has long been with us, in toys and elsewhere, interest in it rocketed during 1958. And nowhere is the interest more apparent than in plastics model kits.

Hundreds of thousands

By now, hundreds of thousands of plastics models of missiles, atomic weapons, rocket ships, and space craft have been sold. These models range in size from a few inches to over 2 ft. long, and in complexity from a few parts to more than 300. All of the kits are realistic, and some are authentic down to reproduction of the last rivet. Even though the real "space age" is less than a year old, space models are already competing with model aircraft for top volume in the plastics hobby-kit field. Total retail busi-

Hobby kits of missiles and rockets are the main staples of the space toy boom. At left is the Honest John missile and launcher made by Adams Action Models. At right is the three-stage rocket with satellite of Lindberg Products. (Photo, Monsanto Chemical Co.)





Major parts for several models of Kusan's line of military missiles are produced in a single injection molding operation. Closeup at right shows complex family mold

Ajax model, shown assembled at right, separates into two stages just like the real thing. Kit comes complete with assembly instructions and data on the Army's Ajax missile (shown at left), and decals

ness in plastics kits is estimated at $100 million a year by the Hobby Industry Association, Philadelphia, Pa.

Bulk of this new business is going to polystyrene, a material which enjoyed a 42 million lb. stake in the toy industry last year. Styrene, both general purpose and impact, monopolizes the model kit field because of its well-known ease of molding—which makes intricate detail possible—surface gloss, full color range, and low cost.

Out front in the space race was Kusan-Auburn, Inc., Nashville, Tenn. Kusan managed to whip seven missiles into production in about two months. It happened this way: the Government invited bids on a special order for models of seven different operational missiles, for its own use. Kusan submitted the lowest bid, with the proviso that it could use the models in its regular toy line. The initial order was placed in the first part of December; by January, 100 units each of all seven missiles had been delivered to the Government, and Kusan was ready to launch its merchandising campaign.

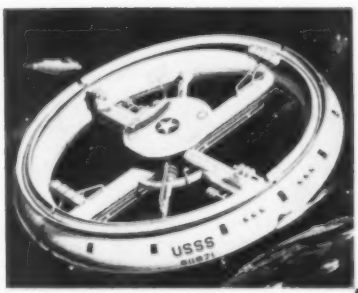
Space toys now on the market range from authentic scale models of operational U. S. missiles, such as Honest John, Corporal, Talos, Snark, etc., to Buck Rogers-like interplanetary space ships. Even the outer space craft, however, like the space ship, three-stage rocket, and moon ship made by Lindberg Products Inc., Skokie, Ill., are based on the best scientific ideas of what these vehicles will look like.

Realism is of prime importance in the plastics model kit field. So important, in fact, that Revell, Inc., Venice, Calif., volume leader of the industry, has a national expert on space technology as a consultant. Revell has a full line of space vehicles on the market, including one particularly impressive model of a three-stage "manned" space ship. (See photos, p. 102). The model can be taken apart to simulate the various flight stages. It stands 14 in. high and is complete down to the launching platform and finely detailed figures of a three-man crew.

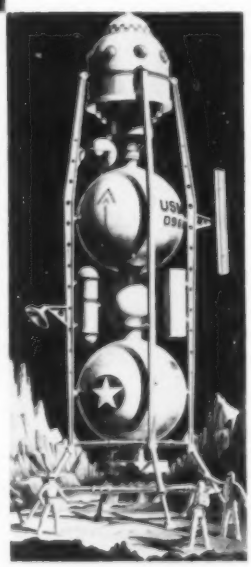
Also typical of the realism in the model kit field is the Honest John artillery rocket made by Adams Action Models, Inc., Hawthorne, Calif. In this kit, the rocket is detachable from the launcher, the crane elevates and swivels, the wheels move, and the jack can be raised and lowered.

Aurora Plastics Corp., West Hempstead, N. Y., has also joined the space model competition with scale copies of the Bomarc and Regalus II missiles, available with or without handsome launching platforms. Though these models have been on the market only a short time, they are already leading sellers.

The new space boom should be even more apparent in the American home this Christmas. By then, the sales curves of some of the makers of plastics model kits should have reached astronomical heights.—End



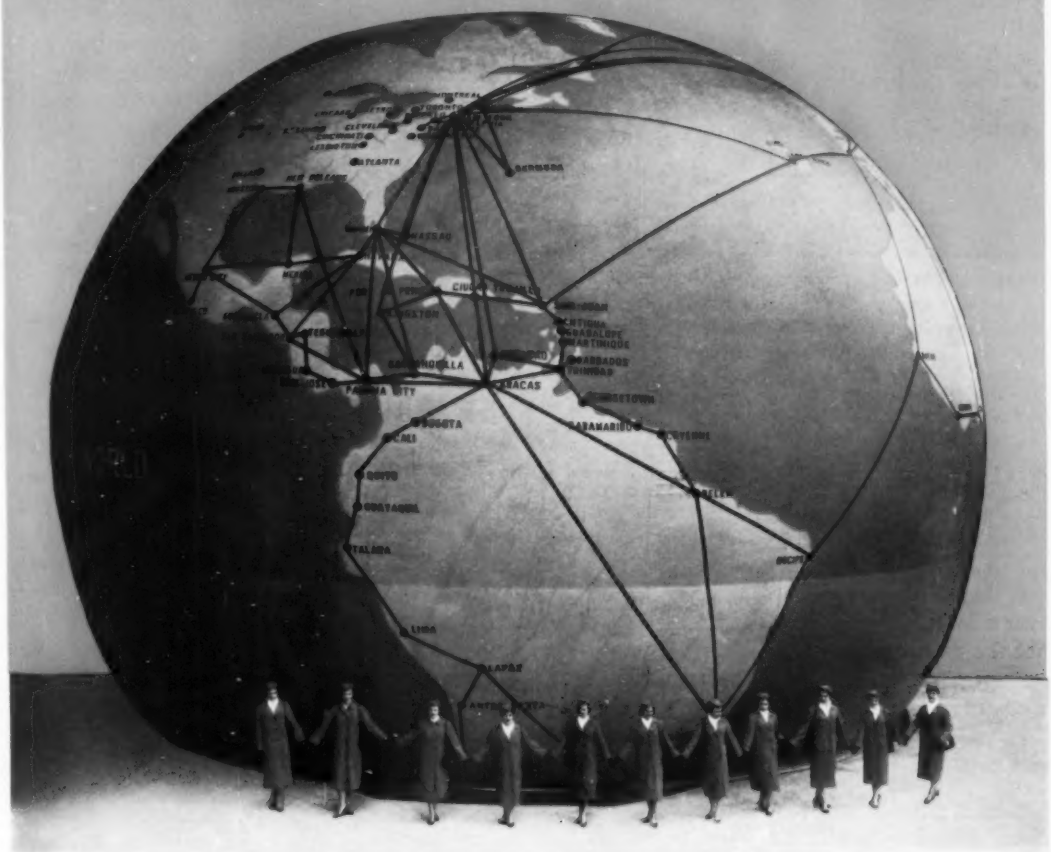
Space station, in the form of a 9-in. diameter wheel, is scientifically accurate conception of what space stations of the future may look like



Model moon ship, molded of silver styrene, reflects advanced thinking of scientists regarding a ship designed to operate in outer space only. It would be launched from a space platform rather than the earth. This highly detailed model, $9\frac{5}{8}$ in. high, has 40 parts. (Photos, Lindberg)

They cover a lot of ground

New materials, based on combinations of plastics and synthetic fabrics, are replacing canvas as paulin and shelter material — at significant savings to the user

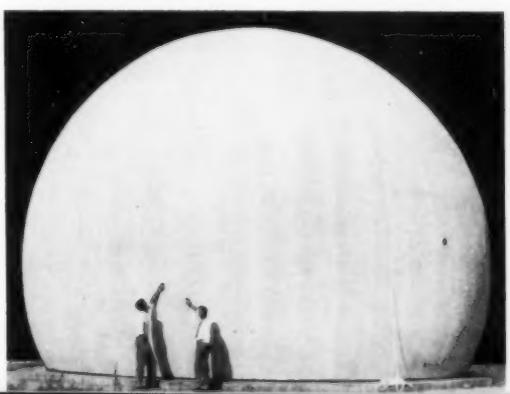


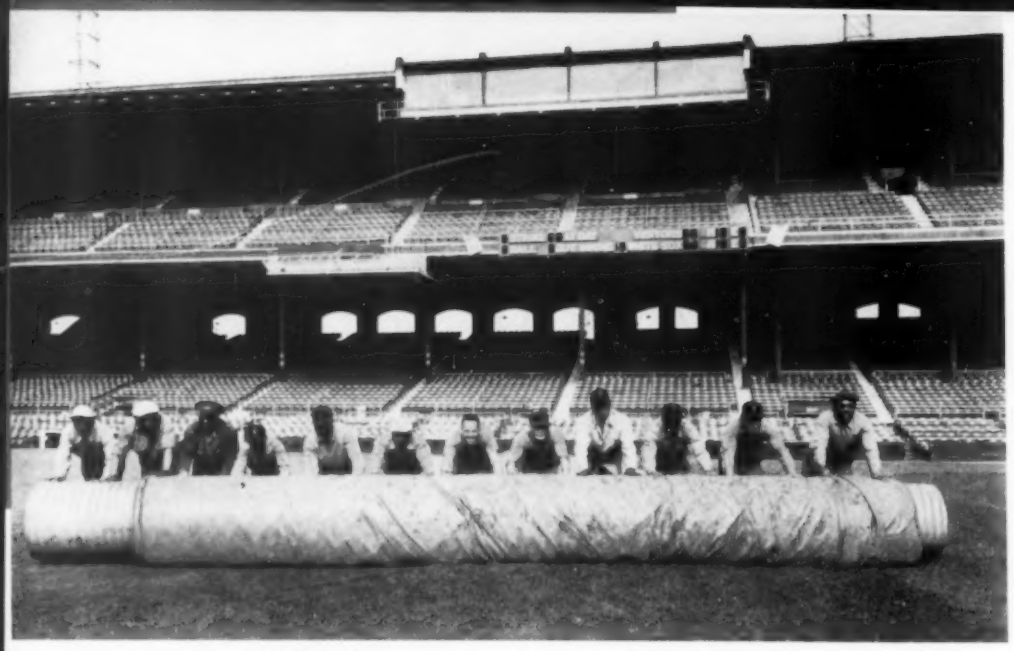
Inflated vinyl-covered nylon globe is part of Pan American Airlines' display at the Brussels World's Fair. The globe shows airline routes on the exterior, while the interior is a planetarium theater. (Photo, U. S. Rubber Co.)

Lightweight, strong, and completely waterproof, plastic-coated synthetic fabrics are challenging the dominance of canvas in the tarpaulin market. They have also made possible a brand new concept in shelter engineering—the airshelter, which is essentially a plastic tarp blown up. In the case of tarpaulins, they provide longer service life than canvas. In the case of airshelters, they make possible extremely low-cost enclosed storage space.

The most important combination is nylon fabric and vinyl. According to Du Pont's Textile Fibers Dept., over 7 million sq. yd. of

Giant radome, which measures 40 ft. in diameter is an adaptation of the air-shelter principle. Collapsed, it can be handled by three men and packed in a bundle less than 4 ft. square. (Photo, Debell & Richardson, Inc.)





Baseball infield cover at Comiskey Park, Chicago, Ill. It takes only half as many men to handle this vinyl-nylon tarp as it did to handle the old canvas cover. (Photo, Hoosier Tarpaulin & Canvas Goods Co.)

vinyl-clad nylon will be manufactured in 1958. Du Pont, which provides nylon and other synthetic fibers, expects demand to reach 20.2 million sq. yd. by 1960; 40.5 million by 1963.

As these estimates indicate, plastic tarps will cover a lot of ground literally and figuratively, once their virtues become more widely known. The material offers a combination of properties that is completely new and thus is finding applications where fabric materials have never been used before.

Airhouses for storage

The outstanding example of such applications is the air-supported structure or "airhouse." Made of vinyl-covered nylon fabric, the airhouse is supported entirely by low-pressure air and anchored to the ground by a tube of the same material running along the base and filled with water. The airhouse yields large area shelter at exceptionally low cost—about $1 per sq. ft. in initial outlay, only a fraction of the cost of other shelters. It is easily erected and can be heated or cooled.

The potential of the air-supported house was immediately apparent when it was first introduced about two years ago, (see M. PL. 34, 116 (Jan. 1957); manufacture and sale of the shelters have been increasing steadily ever since. They are adaptable to all kinds of storage and warehousing, can be used as exhibit halls, theaters, temporary schools,

From tarp to building takes only a few minutes with an airshelter. Workmen stretch material on ground (left), then inflate the structure with a pump (right). After the ring base has been filled with water . . .

mobile offices or shops, retail markets, swimming pools or skating rink shelters, portable greenhouses, and in countless other ways. Where desired, they can be fitted with windows of clear vinyl or polyester film.

The size of an airhouse is virtually unlimited. Irving Air Chute Co., Inc., Lexington, Ky., a big producer in the field, offers regular models covering 17,850 sq. ft. of usable space, and will build larger ones to order. This company's thinking in the airshelter field is bold and far-reaching. One special project is the use of an airshelter for all-weather construction of small buildings such as one- or two-family homes. This application promises to end the bane of construction by providing protection from bad weather. An airshelter is used to roof over an entire construction site, keeping materials and men warm and dry while the building work proceeds.

Another interesting application of the airshelter is a 52-ft.-diameter globe on exhibit at the Brussels World's Fair (see photo, p. 105). The globe's interior serves as a planetarium and has a seating capacity of 150 persons. Irving Air Chute manufactured the globe, using U. S. Rubber's Fiberthin vinyl-coated nylon fabric.

Military uses

The largest customer for the airshelter is and probably will continue to be the U. S. government. The structure represents a solution to countless military problems connected with the swift, temporary housing of men and equipment.

Probably the most important military adaptation of the airshelter to date is its use as a highly mobile radome. Such a radome, in the shape of three-quarters of a sphere that measures 40 ft. in diameter when collapsed, has been developed by DeBell & Richardson, Inc., Hazardville, Conn. (see photo, p. 105). This airshelter, designed to protect a radar antenna from bad weather, will resist winds up to 150 knots, and offers a real solution to the problems of housing radar equipment at remote arctic outposts such as in the DEW (distant early warning) line system. This radome is made of Dacron polyester fiber coated with Hypalon chlorosulfonated polyethylene, both Du Pont products. Design studies have also been made for the use of airshelters as portable hangars and as protection during bacteriological and chemical warfare.

Since the airhouse was introduced, other types of lightweight fabric shelters have been conceived, such as a structure supported by a light geodesic aluminum framework (see photo above).

Plastic Creators, Little Ferry, N. J., has supplied several structures consisting of a steel framework covered with vinyl-coated nylon. The firm has also developed a plastic-coated fabric structure supported by "girders" made of inflated vinyl tubes fabricated by electronic welding (see photo, p. 108).

How tarps are made

The material most commonly used in airshelters and tarps consists of a base fabric of woven nylon cloth protected on both sides by vinyl. This vinyl is applied either by standard

Geodesic dome has a vinyl-coated nylon skin, "buttoned" to a series of disks arranged on a skeleton of aluminum tubes. Structure weighs 4200 pounds. (Photo, Du Pont)

. . . the door structure is installed (below) to complete the job. (Photos, Irving Air Chute)

coating methods using a plastisol solution or by laminating the fabric between vinyl film. The coating process is much older and better established, but laminating has been gaining ground because it permits use of a base fabric which has a lower thread count and is therefore less expensive. Coated material costs about 10 to 20% more than laminated material. On the other hand, the coated product offers better puncture resistance and higher tensile strength. The basic fabric used to produce a 10 oz. per yd. coated material, as supplied by Wellington Sears Co., New York, N. Y., weighs 2.3 oz./sq. yd. To produce a laminated material of the same weight, the nylon fabric need only weigh 1.4 oz./sq. yard.

Big market for tarps

Though the airshelter and its modifications represent a potentially large market for vinyl-covered nylon, the bread-and-butter application is tarpaulins.

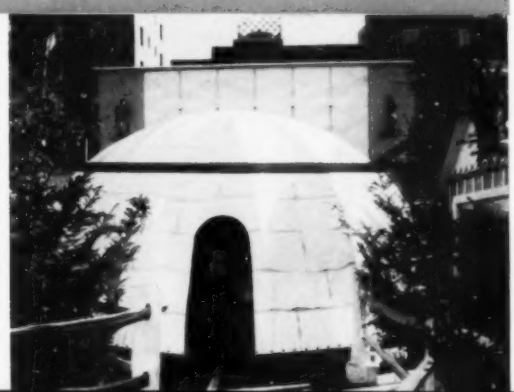
The material has several advantages over canvas: 1) It weighs only half as much as dry canvas of the same tensile strength, and only one-third as much as wet canvas; 2) it is much stronger than canvas: abrasion resistance, tensile strength, and burst strength are all far superior; and, 3) because the material is rot-resistant, it can be folded and stored while wet.

Though the initial cost of a plastic tarpaulin is between 10 and 35% higher than of canvas, the longer life of the plastic makes it less expensive in the long run. Some estimates place the life of a plastic tarp at two or three times that of canvas in the same application.

Plastic tarps range from small blanket-sized affairs to huge super tarps used to protect the whole infield of a baseball diamond; they have a wide range of uses in industry, commerce, and agriculture.

Among the largest tarps in existence are baseball infield covers (see photo, p. 106). Most of the major league baseball clubs have switched to vinyl-nylon tarps for this protective job. The contrast in weight between the new plastic tarps and canvas covers formerly used is very striking: it takes only half as many men to handle the plastic tarp as it did to handle the old canvas cover. (*To page* 208)

Display "igloo" used for promotion at Detroit, Mich., shopping center. Vinyl "girders" are put into protective nylon casings (upper left); girders are erected (upper right); white and red nylon-supported vinyl is drawn over girders (lower left); finished dome is at lower right. Air girders were fabricated by electronic heat sealing. (Photos, Plastic Creators, Inc.)



Japan's place in plastics

By 1960, Japan will be a vigorous competitor in many export markets. Here is why

By J. R. Turnbull

In conversations with people in the plastics industry in the United States, three questions are always asked of those who have spent some time in Japan: 1) What is the present status of the plastics industry in Japan? 2) What competitive threat does it present now or for the future? 3) What are the possibilities of mutually profitable trade and cooperation with firms in the Japanese plastics industry?

Before attempting to answer these questions, it is necessary to consider some of the special Japanese methods of doing business.

Marketing or selling has no place in the Japanese industrial scheme of things. A strata of middlemen termed "trading companies" are between most manufacturing enterprises and the eventual customer. To appreciate the significance of this, let any American businessman try to imagine what his problems might be if he had to operate without contact with either his customers or his suppliers!

The large trading companies, with offices in major cities all over the world, are, in effect, the "plan boards" of Japanese industry. This often results in situations where large segments of Japanese industry are suddenly directed into certain classes of goods or localized markets.

The absurdly low prices of some Japanese goods are often caused by this lack of contact between the Japanese manufacturer and his United States customers. Japanese manufacturers are often misinformed about their competitive position in foreign markets and, consequently, price their goods lower than is necessary, thereby causing protective action in their export markets, which in turn results in "voluntary" restrictions on production.

It should also be remembered that prices of anything in Japan, including plastics resins, have nothing to do with sales quantity. The reputation of the customer, his credit rating, political, social, and cultural prestige are all elements involved in the price quoted.

The author (right) on an inspection tour of the Monsanto-Kasei PVC plant at Yokkaichi, Japan, with (left to right) G. Aoyama, director, Monsanto-Kasei; T. Kuwata, president, Mitsubishi Chemical; S. Satow, president, Monsanto-Kasei; and C. A. Thomas, president, Monsanto Chemical

The author: J. R. Turnbull joined Monsanto Chemical Co. in September 1938, as director of sales promotion and advertising of the newly acquired Plastics Div., Springfield, Mass. He became general sales manager of the division in 1949. In 1954, after service with Monsanto's Western Div., he was appointed vice-president of Monsanto-Kasei Chemical Co., Monsanto's Japanese affiliate, which is jointly owned by Mitsubishi Chemical Co. While in Japan, he was a member of the International Board of Arbitration. Mr. Turnbull returned to the United States in June 1958, and is presently on indefinite leave of absence from Monsanto, devoting his time to private business interests.

Plastics raw materials

Japan is rapidly approaching self-sufficiency in practically all of the commercially important types of plastics and synthetic resins. The only

T. Nakata, plant manager (right), escorts Messrs. Turnbull, Thomas, and Satow through Monsanto-Kasei's plasticizer plant in Nagoya

large tonnage import at present is polyethylene. Urea and polyvinyl chloride are the only resins produced on a scale comparable to U. S. or European levels. There is a good possibility that by the end of 1958, Japan will have PVC resin production capacity larger than any country other than the United States. Briefly, the status of individual plastics materials is as follows:

Polyvinyl chloride resins. There are 13 producers with an aggregate capacity of approximately 120,000 metric tons per year. A number of expansions scheduled for completion in 1958 have been deferred because of a downturn in domestic demand, and because of a lack of established export markets. A majority of the polyvinyl chloride manufacturers are producers of calcium carbide and calcium cyanide for fertilizer.

Polystyrene resins. There are two producers—Monsanto-Kasei and Asahi-Dow. Japanese production commenced in the first quarter of 1957. Present combined capacity is approximately 1000 metric tons per month, which is about equal to present consumption. Styrene monomer for these plants is now imported from the U. S. and carries a 20% duty. Locally made monomer will be available early in 1959 from a plant being constructed by Mitsubishi Petrochemical Co. All important types of general purpose and impact polystyrenes are available.

Acrylics. There are three producers of cast sheet and molding materials, but volume is small because of comparatively high price. The total production reported for the year 1956 was 1000 metric tons.

Cellulosics. Japan is the last stronghold of cellulose nitrate, in which the country had a dominating world-market position prior to World War II. Markets and usage are gradually shrinking, even within Japan. Cellulose acetate is produced by two companies, and total production is approximately 100 metric tons per month, including sheet and film.

Vinyl acetate. This group of resins has grown rapidly because of the development of two textile fibers based on them. The fiber is used for fish nets and heavy-duty work clothing and uniforms. Production in 1956 was 31,500 metric tons.

Urea and melamine resins. There are four main producers of amino resins and molding compounds, but captive manufacture, especially in the plywood industry, is the rule rather than the exception. Total output in 1956 was approximately 70,000 metric tons: in 1958, urea production is expected to reach 76,000 and melamine 7000 metric tons.

Polyethylene. In 1957, Japan imported 20,000 metric tons. At present at least two plants, with a combined capacity of about 32,000 metric tons per year, are on stream. Five plants with a combined annual capacity of 52,000 metric tons are scheduled for completion by April 1959. They will operate under Ziegler, I.C.I., B.A.S.F., Phillips Chemicals, and Standard Oil of Indiana licenses.

Phenolic resins. Molding resins have been relatively static in volume in recent years, but there has been a steady gain in the volume of industrial resins for electrical laminates and other uses. Captive production is common, as in the case of ureas, but there are five large manufacturers of specification materials. Total output in 1956 was 18,000 metric tons, and is expected to reach 21,300 in 1958.

Caprolactam. There are three producers, but the volume used for molding and extrusion is small because of relatively high price. Alkyd, polyester, and silicone resins are also produced on a scale sufficient to meet demands.

Plastics processing industry

Up to and including 1958, the operations of the Japanese plastics processing industry have been almost exclusively geared to supplying the domestic market with components for cameras, radios, electric fans, etc. The export of items made entirely of plastics has not been sig-

nificant. The reasons for this are manifold. In injection molding, for example, the dominance of polystyrene and polyethylene materials has put Japanese molders at a disadvantage, since either the materials themselves or the raw materials to make them have been dutiable at 20% on entry into Japan. The injection machine itself is a great equalizer and can hardly be operated in Japan at any significantly lower overall cost than in the U. S.

In extrusion, the Japanese have done well with unplasticized PVC. With this exception, the higher cost of plasticizers and the duty on polyethylene have kept finished extruded products out of most overseas markets. The same observations can apply to calendering and almost all other processing methods, but the problem is recognized and measures to solve it are being taken. Of course, the plastics processing industry has low-cost labor by the standards of any other industrialized nation in the world. In large manufacturing firms, the average wage per month would be on the order of $65. In small plants, wages as low as $25 per month are not uncommon, especially for assembly and fabricating labor.

Since standard Japanese education is the highest in the world—99.4% literacy with English a required subject—there is an actual oversupply of competent technical talent, and Ph.D.s can be obtained at salaries not much higher than those of labor. A highly trained technical staff is a matter of "face" on the part of Japanese industrialists. These chemical engineers and chemists are calling the shots on quality demands. As a matter of fact, as far as vinyl is concerned, the quality demands of Japanese processors are substantially higher than those of calenderers, molders, and extruders in the United States.

Injection molding. This field bears some resemblance to the pre-war status of the industry in the United States. Short runs are the rule and few if any molders are engaged solely in proprietary molding. Competition for custom molding work is very intense, and large users have captive shops which supply the major part of their requirements.

Molding establishments comparable in size and equipment to those which are now fairly common in the U. S. simply do not exist, as is indicated by the fact that the 120 largest molders in Japan had a combined injection capacity of only 3000 oz. at the end of 1956, composed of 88 imported machines, and 415 Japanese made machines.

There are a large number of small machines, mainly hand-operated, which supply novelties, toys, etc., which are non-critical in color standards or physical properties. A number of firms are engaged in the injection molding of rigid PVC, producing various fittings and junction boxes for use with PVC pipe and electrical conduits.

Extrusion. With the exception of garden hose, for which there is little demand, counterparts of most U. S. flexible extruded products are manufactured in Japan. There is also large-scale production of insulated wire and cable.

Unique to Japan is the important position of rigid PVC processing. There are several plants, each capable of producing close to 500 metric tons per month of rigid PVC pipe and conduit, as well as a half-dozen smaller operators with capacities in the range of 50 to 150 metric tons per month. The slit-tube method is also used by at least one pipe extruder for making heavy-gage rigid PVC sheet and plate.

Rigid PVC pipe has been found extremely satisfactory in Japan for both municipal and agricultural water-distribution lines; it is also extensively used for corrosion-resistant piping. Fabrication and installation is carefully and skillfully done, and the PVC pipe is fully competitive with steel and iron pipe.

The lack of modern wide calenders has prompted many firms to produce plasticized PVC film and sheeting by ex- (*To page* 204)

Inspection party observes operation of calender at Monsanto-Kasei plant

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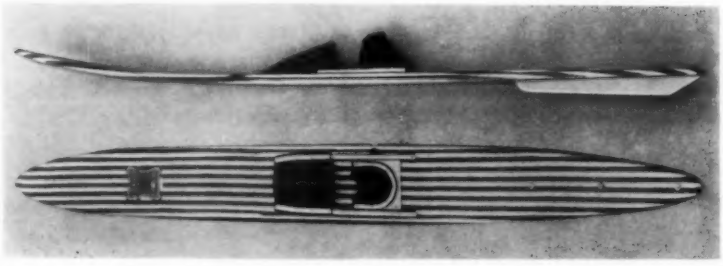


5

PLASTICS

1 With a little practice, a youngster can learn to spin the Wham-O Hula-Hoop around the waist, neck, or knees—even to spin two or three hoops at a time. Ridges on the inside circumference help keep the rotating hoop against the user's body. The hoops are manufactured from Grace's high-density polyethylene by Wham-O Mfg. Co., San Gabriel, Calif.

2 Electric fences are easier to string when new one-piece molded fasteners are used to hold the wire in place. The device has two curved arms, one open at top and the other at bottom. The wire is simply slipped over one arm and under the other, yet is held securely. Made of Eastman's butyrate, the fastener can be nailed or screwed to the fence post. It is molded by American Plastics Corp., Bainbridge, N. Y., and marketed by Hil-Myer Electric Fence Fastener Co., New Berlin, N. Y.

3 The fully equipped home bartender can now mix his Martinis to exact proportions in an "automatic" cocktail blender. The mixer has a novel arrangement of plastics containers, one inside the other, that pour simultaneously through the same spout, a dial on the cover controlling the flow of liquids from both containers. The inner container and pouring lip are molded of Koppers' high-density polyethylene. The outer bowl is molded of clear Bakelite C-11 acrylonitrile-styrene copolymer by Avsco, Inc., 940 Isley Blvd., Excelsior Springs, Mo. The cocktail blender is manufactured by Research to Reality, Detroit, Mich.

4 New high-density polyethylene baby dish can withstand the heat of an automatic dishwasher or steam sterilizer. The dish is partitioned and slanted to aid the child in feeding himself. Two suction cups on the bottom hold it in place on table or high-chair. Called the Tommee Tippee dish, it is molded of Celanese's Fortiflex by Westland Plastics, Inc., Los Angeles, Calif.

5 Colorful new water-skis, molded of reinforced plastics, provide high performance as well as good looks. Incorporating a flotation core of balsa wood, the lightweight skis combine high strength with high flotation. They are produced in matched metal molds of chopped strand fibrous glass mat and polyester resin with a pat-

terned decorative overlay. Manufactured by Kimball Mfg. Corp., San Rafael, Calif.

6 The Snorkel plastic lawn spray kit is attractive, corrosionproof, and tough enough to withstand abuse from lawn equipment such as mowers, rollers, and rakes, as well as freezing in winter. The tubing of the kits is extruded of polyethylene by Skyline Industries Sales, Inc., Titusville, Pa.; the fittings are molded of Marbon Chemical's Cycolac.

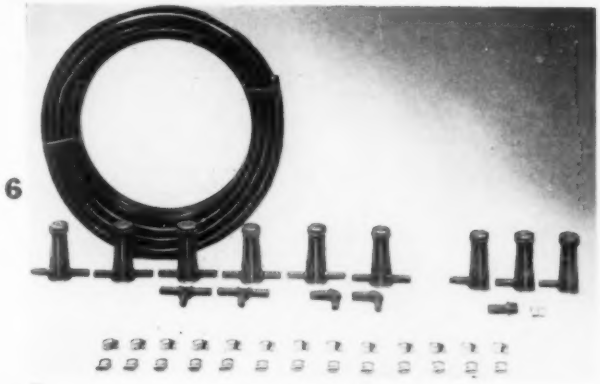
7 The Evenflo educational food warmer, with three sections for food, features a letter of the alphabet at the bottom of each section, linked to a common illustration, and a transparent cover. Hot water in the base keeps the food warm. Molded of Bakelite SMD-3000 styrene by Pyramid Rubber Co., Ravenna, Ohio.

8 Tap-it nylon anchors will fasten almost anything to any material, including concrete, glass, and metal. To apply, an anchor-size hole is drilled through the object into the surface to which it is to be fastened. Then the anchor is inserted into the drilled hole, and a metal pin supplied with each anchor is hammered in. The pin spreads the anchor so that it will hold permanently. Three different sizes of the Tap-it anchor are available from the manufacturer, Robert Q. Partridge Products, Inc., 1010 E. 15th St., Hialeah, Fla.

9 A new dishwashing tool consists of a screw-on brush tufted with nylon bristles and a pink squeeze bottle of polyethylene which holds soapy water. A hole in the cap permits suds to be squeezed over the brush, which is rounded for fast cleaning of cups, tumblers, and glassware. A companion product, on the market for some time, has a flat, angled head for scrubbing pots, pans, and table tops. Made of Du Pont resins by Anro Products Co., Aurora, Ill.

10 Basketballs rotationally cast from Bakelite vinyl-based plastisol are the same size and offer the same surface detail as official types—at one-fifth the cost. The vinyl balls are moistureproof and will withstand hard use on asphalt, cement, and other rough surfaces. They are manufactured by National Latex Products Co., Ashland, Ohio.

PRODUCTS



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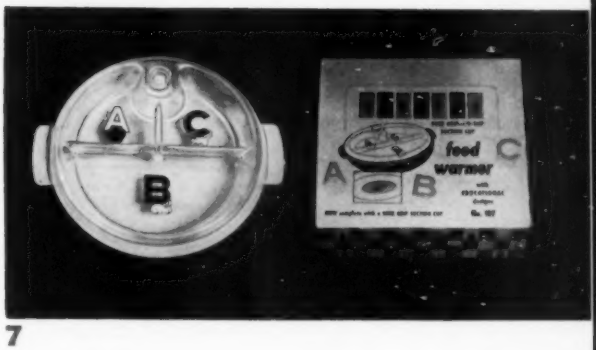

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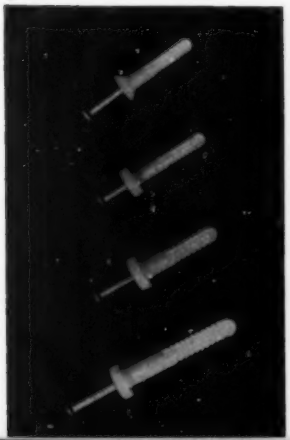

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Plastics Engineering*

Dr. James F. Carley, Engineering Editor

Continuous forming of fibrous mat

By Peter E. Fuerst†

A new process for continuously forming fibrous mats, with or without fillers, resins, and other additives, is now in use for making the cores of high-pressure decorative laminates. For this purpose, the process offers many economies over the conventional process, and greater flexibility. Continuous forming has also been experimentally successful in making fibrous glass mats of much better uniformity than those now commercially available. Composite mats containing 60 to 80% glass and 40 to 20% kraft or other cellulosic fibers can be used to make polyester laminates with strength properties about equal to those using only glass reinforcement, but with appreciable savings in the weight of the finished laminate and the cost of the reinforcement.

Most high- and low-pressure plastics laminates made today are based on some sort of fibrous sheet material—paper, cloth, or fibrous glass mat or cloth. Since the cost of weaving cloth is high, the bulk of these laminates use felted materials—papers and mats.

Present paper-making machines —the Fourdrinier and cylinder —are not capable of producing thick paper felts because they depend mostly on gravity and suction for deposition of the slurried fibers, or pulp, on the screen. Another characteristic of these machines is that there is usually some dominant orientation of the fibers in the felts, with the result that their strength properties are anisotropic. From the standpoint of the decorative laminate maker, both these characteristics are undesirable—he needs a rather thick mat and would prefer it to be uniformly strong in all dimensions.

Until recently, all high-pressure decorative laminates were made up of six or more layers of paper, each impregnated individually with liquid resin and dried, then laid up prior to being pressed together. The continuous pressure forming process described below makes it possible to eliminate much expensive equipment and many handling operations by producing a single, resin-impregnated mat of the desired thickness directly from wastepaper pulp. Only the decorative and clear overlays need be laid over this mat to make it ready for pressing into a finished laminate. And the pressure forming process yields an isotropic mat.

In making glass mat for low-pressure reinforced molding, the picture has been somewhat different. These mats are made by air-blowing chopped glass onto a screen, at the same time spraying on a small amount of binder resin. Because the fibers are relatively long and are much denser than air, they are difficult to distribute evenly on the screen, with the result—of which reinforced plastics molders are sadly aware—that point-to-point variations in mat density are large. A typical figure: when foot-square samples of such mats were weighed, the standard deviation of the weights was about 15 to 20% of the average weight. This means that about 3% of such samples—and a 1-ft. square is a pretty big area in some moldings —will be more than 30% deficient in the only material that can give strength, the reinforcement. The variation would be even bigger with smaller samples. If this variation could be reduced to perhaps a quarter of that value, many moldings now made partly or wholly with cloth could be reinforced entirely with mat. Samples of glass mats that were pressure-formed from water slurry and contain a few percent of cellulosic binding fibers varied only about 3% in weight. This is a 6-fold gain in uniformity. More about such mats later.

The materials that may be matted by the pressure forming process run the gamut of fibers, with the possible exception of steel wool. Cotton linters, jute, wood pulp, nylon, rayon, asbestos, chopped glass, waste fiber from

*Reg. U. S. Pat. Off.

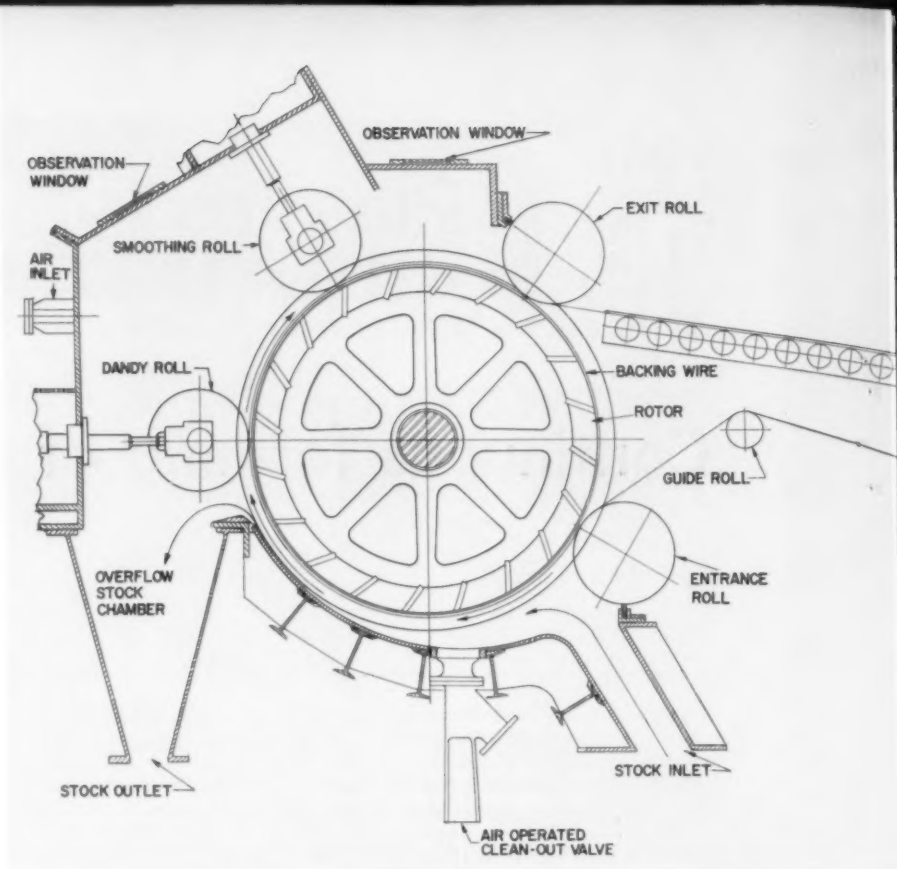
† Research Engineer, The Forming Machine Co. of America, Inc., 18 Hamilton St., Bound Brook, N. J.

auto tires, digested sewage sludge, shredded leather, and bark have all been successfully matted by the continuous pressure process. Nor is it difficult to deposit with the fibers a wide variety of other materials—resins, sizes, pigments, etc. Even grass seed and fertilizer can be bound up in a matrix of fiber to make an artificial turf!

New machine does it

At the heart of the process is a continuous mat-forming machine. This is a rotary pressure filter, using a fine-mesh, stainless-steel-screen belt as a filter medium, into which can be fed a steady stream of fibrous slurry. Figure 1, right, is a schematic drawing of the essentials of this device.[1] At each end of a perforated rotating drum is a rim or flange, between which the screen rides. The flanges form part of the sealing mechanisms which permit the continuous removal of the mat from the pressurized area without losing any of the slurry or pressurized air. This is done with synthetic rubber rolls across the width of the screen between the flanges, one located at the point where the screen emerges from the chamber, the other where it re-enters. These rolls are held in place at a pressure which is sufficiently greater than the inside pressure to make an effective seal. In the gap between the two rolls, and around them, the seal is maintained by a continuous strip of synthetic rubber (see inset, Fig. 1), that is in constant contact with the surfaces of the flanges and of the rolls. By introducing air behind this strip at a pressure slightly above that maintained in the chamber, a tight seal is obtained at all points.

[1]Subject of several patents issued to Alvan D. Simpson, president of the author's company.



The machine is similar to other continuous filters used in the process industries and to the cylinder machines of the paper industry. The major difference is the use in this machine of high pressure instead of vacuum as the driving force. Conventional equipment is theoretically limited to 14.3 p.s.i. (at room temperature), and in practice the operating differential is about 8 to 10 p.s.i. The continuous mat former can be built to withstand gage pressures of from 50 to 100 p.s.i. without going to cumbersome or expensive design.

In addition to higher rates and greater flexibility, the use of pressure gives a much more uniform driving force, therefore, a more even mat. Also, pressure equipment such as centrifugal blowers and compressors can handle large volumes of air economically, whereas vacuum systems are limited in this respect. The availability of large volumes of air enables the pressure former to felt efficiently materials that are free or porous and that cannot be picked up with conventional cylinder machines.

The large driving force available in more rapid deposition results in more rapid deposition of the fibers and additives than

Fig. 2: Pilot mat-forming machine makes 36-in.-wide fibrous glass mat; is much like 54-in. machine shown in Fig. 1, above

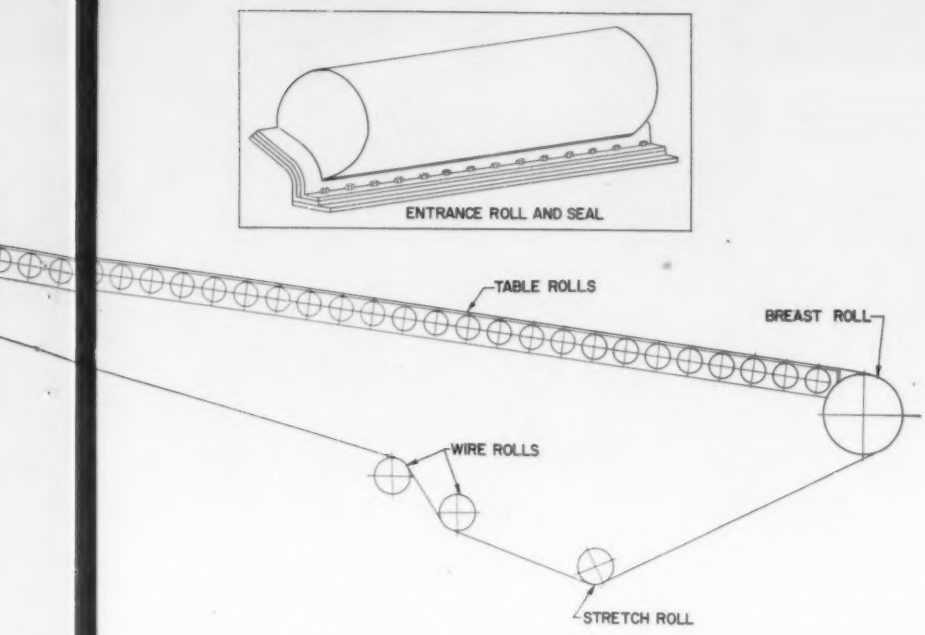


Fig. 1: Continuous pressure forming machine for making fibrous mats. Stainless screen enters pressure chamber at entrance roll and passes around perforated drum. Slurry enters at bottom right under pressure and the water passes through to the interior of the drum, leaving the fiber, resin, etc., matted on the screen (the screened water is taken off through the ends of the drum). Excess slurry spills over at left, returns to supply tank, and rising mat is dried by air under pressure passing through to the interior of the drum. At top, screen with partly dried mat emerges through exit roll and starts down table, where mat is trimmed to desired width. At breast roll, extreme right, mat is taken off for further drying, while screen goes back to pressure chamber. Screen may be scrubbed, chemically treated, or even flame treated on return trip. Inset shows details of entrance roll and seal

can be obtained by vacuum systems. This insures a much more isotropic mat, as the following flexural strength results demonstrate:

Tests on a popular decorative laminate showed a lengthwise strength of 18,300 p.s.i.; a crosswise strength of 22,800. The corresponding figures for a similar laminate made from pressure-formed, paper-mill-effluent fibers were 19,200 and 19,500 p.s.i. (Even this slight difference in crosswise and lengthwise strengths disappears if only the core material is tested—the decorative-overlay paper has strong directional properties of its own.) This comparative lack of directionality in the pressure-formed mat can be verified by a careful examination of low-power photomicrographs of the products of the various slurry-felting processes.

While the machine will filter and felt anything that can be uniformly dispersed in a liquid slurry, in most cases, where the prime interest is in making a sheet, some minimum amount of fiber is needed to bind the mat and give it wet strength. Mats have been formed from slurries in which the solids consisted of as little as 15% fiber, with 85% inert fillers. Only in a pressure system can mats with such low percentages of fiber develop enough strength to be handled after the sheet is formed.

Design of the machine is flexible as to size and production rates. The first machine in commercial use (see Fig. 2, opposite) is forming core for decorative laminates. It delivers a sheet 54 in. wide at an average rate of 75 ft./min.; speeds up to 125 ft./min. have been achieved with certain fibers. The thickness of the mat is limited to 2 in. by the depth of the end flanges, but for most fibers there is a porosity factor measured as freeness (1)[2] which would limit the thickness to some lower figure. Width of mat is limited by design considerations to 6 ft.; the practicability of greater widths is being studied.

Control of mat deposit

With any given combination of fibers, resins, and fillers, the mass per unit area of the mat, its dryness, density, and mechanical properties can be controlled, within limits, by the three major operating variables: 1) belt speed; 2) forming pressure; and 3) slurry consistency. The graphs of Fig. 3, below, and Figs. 4 and 5, p. 120, show variations in weight of mat deposited per unit area as control factors changed.

The shape of the curve of Fig. 3 is reasonably close to what would be expected from filtration theory (2) for a slurry filtered at constant pressure. If the material forming the mat were incompressible, the thickness built up at any given speed would be directly proportional to the filtration pressure. Figure 4 shows that this was not the case for the 80%-news-print, 20%-kraft slurry filtered in those runs. Newsprint mats, especially, are compressible, and, as the pressure builds up, the free volume in the mat is sharply reduced, slowing down the rate of deposition. With an "incompressible" fiber such as glass, the filtration rates are very

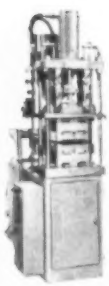
(*To page* 120)

[2] Numbers in parentheses link with references, p. 209.

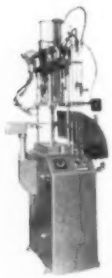
Fig. 3: Thickness of newspaper mat drops as belt speed rises. Slurry consistency in these runs was 1.55%; pressure, 18 to 20 p.s.i.

A few of the Stokes Model 741's that run round the clock at Pass & Seymour, Inc. These machines are equipped with La Rose pre-heaters to automatically feed pre-heated molding powder

OTHER STOKES PRESSES FOR THERMOSET MOLDING

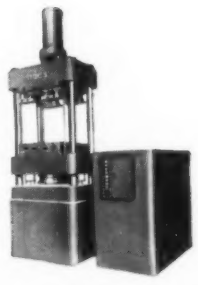


The Stokes Model 800 automatic . . . 15 and 25 ton models. Has all the advanced features of the larger Model 741's.



The Stokes Model 725 automatic . . . 25-ton capacity. A simple low cost machine for varying production runs.

The Stokes Model 726 semi-automatic compression molding press. 50, 100, 200 and 300 ton models.



The Stokes Model 727 semi-automatic transfer molding press. 50, 100, 200 and 300 ton models.

Some of the many parts produced on Stokes automatic molding presses at Pass & Seymour, Inc.

40-million parts per year from Stokes automatic presses at Pass & Seymour, Inc.

This manufacturer of wiring devices now has 42 Stokes automatic compression molding presses in operation in their Syracuse plant. Most of these operate on an around-the-clock schedule.

Pass & Seymour, Inc., produce hundreds of different plastic bodies and fittings for household and industrial wiring devices—such as switches, convenience outlets, sockets and wall plates. Completely dependable operation with minimum down time has been absolutely essential to this high volume producer. Field interchangeability of Pass & Seymour parts necessitates dependable molding accuracy.

According to Mr. D. C. Amsler, Factory Manager —"We believe that these presses represent the most economical means of producing our parts. This stems from the fact that these presses are automatic, require a minimum of maintenance and a minimum of skilled help. Due to the fact that they are fully automatic, they can be operated around the clock. Therefore, the required production volume can be obtained with a minimum mold expense as compared to large multi-cavity compression molds or transfer molds. We are well satisfied with the performance . . .".

For your own molding operations, it will pay you to check the advanced features of the Stokes 741's that bring you fully automatic compression molding in its most fool-proof, most productive form.

25 years of leadership in automatic molding is built into these presses:

Positive ejection, top and bottom . . . parts are mechanically combed off ejector pins on both top and bottom ejection.

Parts can't fall back into molds . . . feed and comb form a box closed front and back. Scrape-off discharges parts independent of gravity.

Simplified set-up . . . feed changeovers made in five minutes from pre-set loading boards . . . no cups to shift or adjust each time.

Fastest cycles, higher output . . . dry cycle time is only 8 seconds. Fast closing and pressing speeds let you take full advantage of fast curing compounds.

Tops in versatility . . . Hydraulic top and bottom ejectors and fully adjustable breath controls are standard. Side draw . . . automatic powder pre-heat . . . automatic rope pre-mix feed . . . fully automatic transfer are available to suit the job.

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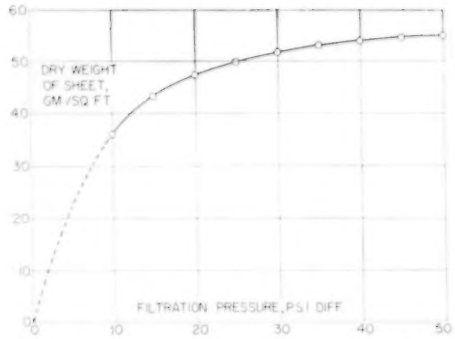


Fig. 4: Compressibility of 80% newsprint pulp results in increase of resistance of mat to filtration with increasing pressure. With an incompressible material, sheet weight would also increase rapidly with pressure at the higher pressures

much higher than these at high pressure. Of course, we should expect that as the solids content, or consistency, of the slurry increases, more mat will be laid down at a given pressure and belt speed, though theory predicts that even with dilute slurries the graph of sheet weight versus consistency should be slightly curved. This is what we see in Fig. 5. (The nature of this curve at consistencies below 0.25% would be interesting to see, but unfortunately the mat formed of news slurry at such low values is too thin and fragile to strip off the screen.)

Now making cores for decorative laminates

The first mat forming machine in commercial operation is a 54-in. unit that is being utilized to make phenolic-resin-impregnated cores of decorative laminates for Form-A-Lite, Inc., Northbridge, Mass.

When the forming machine is used to make such cores, the laminator, instead of buying the relatively expensive saturating stock, buys *waste* news-print and kraft papers. These are weighed and loaded into a Hydrapulper (3) where they are reduced to a fibrous slurry. The slurry is refined to a predetermined freeness, then pumped to a tank in which it is blended with a second slurry containing insoluble phenolic resin. From there it goes directly to the mat forming machine where it emerges as a mat containing about ⅓ solids, with the resin uniformly distributed among the fibers. The mat is dried to about 6% moisture in a long, high-velocity-air drier, care being taken to keep all parts of the sheet below the temperature at which the resin might begin to cure. The dried sheet is then cut to size and stored in a controlled atmosphere until it is to be laminated. Laminating is much the same as in the conventional plant, except, of course, that only one or two sheets are required for the core.

This simple process offers a number of advantages: 1) substantial savings in labor are made because paper making and saturating are combined (incidentally eliminating the papermaker's mark-up), and because fewer sheets need be cut and handled in making the laminates. 2) Cheaper raw materials may be used, and may be used in any ratio, thereby yielding flexibility in cost and physical properties. Figure 6, p. 122, shows how the flexural strength of the laminate varies with kraft content in the news-kraft mixture. The variation in cost presents a similar picture. 3) A major source of savings is the ability to re-use most of the trim and scrap developed by the system, simply by repulping; only scrap from cured sheets cannot be recovered. 4) Since the forming machine uses a closed system, no raw materials are lost in the way solvent is lost in some liquid saturating systems. 5) The production capacity of a single machine is large. For example, the 54-in. machine that was installed at the Northbridge plant makes core for over 200,000 sq. ft. of laminates per 24-hr. day.

The product formed on the machine has physical properties that are directly related to the raw

Table I: NEMA specifications versus typical 1/16-in. laminate properties

Test	*NEMA specification*	*Formed-mat laminate with 30% resin*	*Formed-mat laminate with 15% resin*
Water absorption, %	6.0 max.	5.2	7.8
Thickness gain, %	6.0 max.	5.0	8.2
Flexural strength lengthwise, melamine face in compression, p.s.i.	18,000 min.	23,000	18,500
Flexural strength lengthwise, melamine face in tension, p.s.i.	12,000 min.	15,500	12,000
Flexural strength crosswise, melamine face in compression, p.s.i.	18,000 min.	22,500	17,000
Flexural strength crosswise, melamine face in tension, p.s.i.	12,000 min.	16,000	11,700

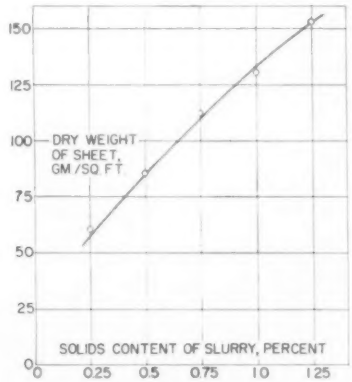


Fig. 5: Mat weight is almost proportional to slurry consistency over range tested. Solid material here was ⅓ phenolic resin, ⅔ waste kraft, filtered at a pressure of 20 p.s.i., and a belt speed of 68.5 ft./min.

Film of TENITE POLYETHYLENE offers "protection" in practical ways

The usefulness of film extruded from Tenite Polyethylene seems to be limited only by the ingenuity of designers.

Take the application shown here as an example. The tempting flavor of fried chicken is sometimes outweighed by the dislike many people have for soiling their hands. Now, thanks to these polyethylene mitts, they can have their fried chicken and eat it with complete enjoyment.

Fabricated from tough Tenite Polyethylene film, the mitts have a separate compartment for the thumb and extend well over the wrist. Because polyethylene is a good barrier to both grease and moisture, there's no chance for a diner to soil his fingers. And, since polyethylene is inexpensive, restaurant operators can provide these mitts free with every order of fried chicken or barbecued ribs. Similar mitts, by the way, are available for use in painting, gardening, and various household and industrial chores.

Film extruded of Tenite Polyethylene is a good choice whenever you need protection against water, grease or solvents. It is tough, resists puncture and doesn't tear easily. Its heat-sealability means easy, sure closing for packaging...or easy joining in fabrication of items such as these handy mitts.

Film of Tenite Polyethylene is available with a high degree of clarity and in a wide variety of colors. For more information on the many uses of film extruded from Tenite Polyethylene, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
POLYETHYLENE
an Eastman plastic

Mitts fabricated by
Vonco Products, Inc.,
151 Hawley St., Grayslake, Ill.
Film extruded by
Flex-O-Glass, Inc.,
1100 North Cicero Ave.,
Chicago 51, Ill.

materials used. In developing core materials for decorative laminates, the NEMA requirements (4) were used as the base, with cost as a major consideration. One of the fiber combinations which offered flexibility in cost and properties was waste news-print and waste kraft. Using this fiber combination, data were obtained which indicated that flexural properties were improved as the kraft content was raised (see Fig. 6). At the same time it was noted that water absorption diminished slightly as the waste news-print content was raised. The freeness increased as the kraft content was raised, making it easier to form thick sheets. By considering these data it was possible to achieve an optimum combination of waste news and kraft from which to make a low-cost core material that exceeds NEMA requirements.

Additional reductions in price can be made by lowering the resin content but, with few exceptions, experience has shown that about 30% by weight of the finished sheet must be phenolic resin in order to be sure of meeting NEMA requirements. Table I, p. 120, makes a comparison in physical properties between NEMA specs and cores containing 30% resin and 15% resin made on the forming machine. As might be expected, the properties are relatively poorer at the lower resin content.

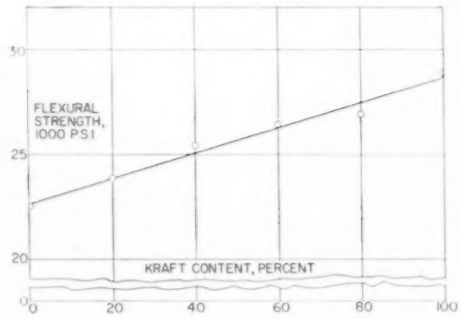


Fig. 6: Flexural strength of laminates made with kraft-and-news cores containing about 32% of phenolic resin improve as the kraft content increases

Although more experience is needed, there are strong indications that this particular method of forming core material results in a sheet that can be easily postformed without the use of the crepe paper. Indications are that the complete random distribution of the fibers in the sheet, coupled with the excellent distribution of resin particles among the fibers, allows the freedom of movement in the sheet that is necessary to achieve a successful postforming operation.

Glass mats are also good

Although no glass mat is as yet being made commercially on the continuous mat former, the process has been investigated for this purpose on a small scale. The only published information on these mats was presented in a detailed report by Coleman, Welsh, and Wenzell (5), who tested laminates made from mats containing various percentages of glass, kraft, and cellulose acetate fibers. Table 2, below, summarizes their results on the mats contain-

(*To page* 209)

Table II: Properties of glass-kraft composite mat laminates[a]

Mat composition	*Glass fiber length*	*Resin content of laminate*	*Flexural strength*	*Tensile strength*	*Notched Izod impact*	*Water absorption (% wt. gain 2 hr. boil)*	*Specific gravity*
	in.	*(% by wt.)*	*p.s.i.*	*p.s.i.*	*ft. lb./in.*		
50/50 glass/bleached kraft	½	64.0	26,000	11,000	5.7	1.3	1.27
" " " "	"	—	25,000	16,000	5.8	1.5	
60/40 " " "	"	61.0	30,000	18,000	8.0	3.8	1.34
" " " "	"	56.0	32,000	—	—	3.0	1.32
" " " "	"	52.0	30,000	—	—		1.36
" " " "	"	60.0	40,000	—	—	2.0	1.34
" " " "	"	68.0	38,000	—	—		1.31
" " " "	"	61.0	35,000	—	—	2.0	1.33
" " " "	"	61.0	32,000	—	—	3.0	1.33
70/30 " " "	"	55.0	37,000	23,000	8.0	4.0	1.38
" " " "	"	60.0	40,000	13,000	7.6	2.0	1.37
" " " "	"	66.0	24,000	—		2.0	1.38
" " " "	"	59.0	27,000	—		2.0	1.34
80/20 " " "	"	56.0	28,000	19,000	4.6	3.0	1.44
90/10 " " "	"	67.0	23,000	15,000	6.4	1.5	1.42
Owens-Corning 219 Type, 1½ oz. per sq. ft.		50.0	35,000	16,000	10.2	less 1.5	1.63
Owens-Corning 219 Type, 1½ oz. per sq. ft.		53.0	34,000	19,000	11.8	less 1.5	1.60

[a] All laminates were ⅛ in. thick and were cured 15 min. at 110°C. under 40 to 50 p.s.i., followed by a postcure of 1½ hr. at 120°C. All panels were prepared using MR-28C polyester resin catalyzed with 1% benzoyl peroxide.

High-speed masking process

uses sprayed coating that is stripped off after decorating

*By Robert W. Clogg**

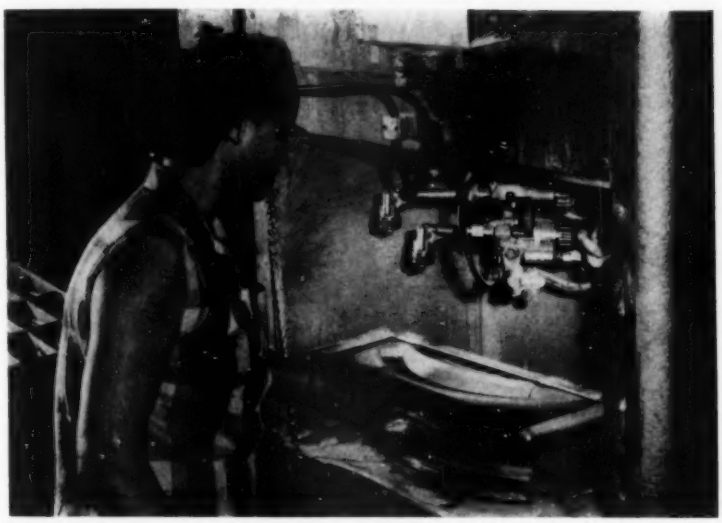


Fig. 1: Injection molded speedometer dial is placed on elevating platform beneath steel mask in automatic spray chamber, prior to spraying on the masking film

A new high-speed, low-cost process for masking injection molded acrylic and polystyrene parts for spray painting, vacuum metallizing, and other finishing operations opens up many decorative design possibilities which until now have been impractical or prohibitively expensive. The new process utilizes a coating that is sprayed onto areas to be masked and hardens to form a tough protective film. It is peeled off after the decorating operations are complete.

This spray-coated masking process represents the first practical and economical method for masking clear "window" areas on clock faces, radio dials, speedometer dials, gage faces, and other plastics parts where border metallizing is appropriate. By previous methods, masking for border metallizing was cumbersome and expensive, requiring individual plug masks or shields for each part placed in the metallizing chamber. Tooling costs for these masks were high, and the quality of finished parts was not always up to standard due to variation in the fit of individual masks to parts. The spray-mask system overcomes these difficulties and gives designers wide latitude in planning border metallizing around clear window areas.

Water-dispersed plastic resin

The masking compound (Spraylat SC-1075) is a water dispersion of plasticized synthetic resins. It is inert to the plastic on which it is sprayed, and has no effect on painted, lacquered, or enameled surfaces. And it can be applied with the standard hand-held or automatic, pressure-type spray equipment.

When dry, the film is smooth and translucent, without air bubbles, and acts as an excellent barrier against lacquers and vacuum metallizing. It adheres snugly to acrylic surfaces so that paint overspray and metallizing deposits cannot run under the edges. Yet when decorating is complete, the film and the accumulated overcoatings can be removed simply by blowing them off the protected surface with a strong air jet.

Masked speedometer dial

The system was used by Andover Industries, Inc., a subsidiary of Erie Resistor Corp., in producing speedometer dials for the 1958 Ford. Surface vacuum metallizing is the primary decorating method on this injection molded acrylic part.

The molded speedometer dial is placed on a platform in an automatic spray chamber (see Fig. 1, left). The platform lifts and presses the dial into a form-fitting stainless steel lip mask which exactly covers the areas to be metallized. A ridge around the lip-mask opening fits into a groove around the border of the window area (see Fig. 2, p. 124, giving an extremely sharp break between the window and the border to be metallized. Openings in the lip mask expose the speedometer and odometer window surfaces, and through these openings the protective coating is sprayed. Automatic sprayguns, arcing across the part in several fast passes, apply a 2-mil film to the exposed window surfaces in a few seconds.

Under the tray system of handling parts, sufficient time elapses between operations to allow the film to air-dry while the parts are on the trays. In an in-line set-up, a bank of radiant heating elements and a blower dry the film fast enough to permit a continuous operation. When the masking film has dried, a base coat of black lac-

*Spraylat Corp., 1 Park Ave, New York 16, N. Y.

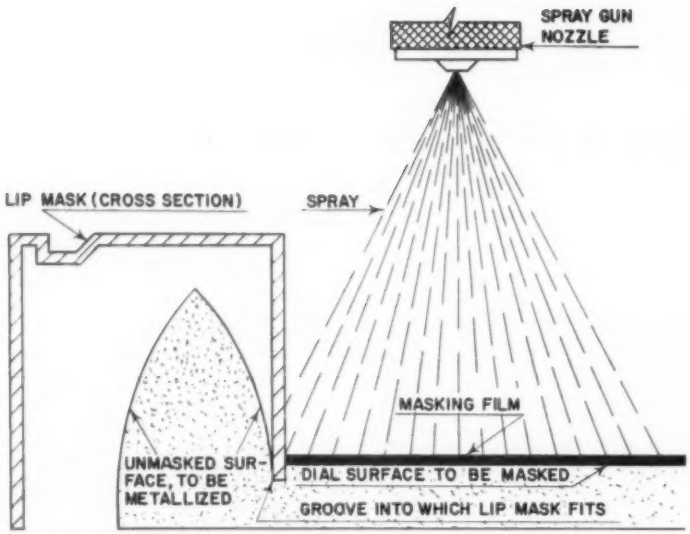


Fig. 2: Simplified cross section through portion of speedometer dial shows how edge of mask fits into groove in surface to be masked. This technique gives an extremely sharp break between the masked and unmasked surfaces

quer is applied over the entire surface and baked on. Then the vacuum metallizing is done. Finally a coat of clear lacquer—the seal coat—is baked on. Lacquer solvents do not penetrate the film, which neither blisters nor causes outgassing during metallizing.

After decoration is complete, the edge of the protective film is pulled free from the window with a wood or nylon wedge, and the film, with accumulated overcoatings, is blown off with a concentrated air jet, as in Fig. 3, right. Removal takes less than 10 sec. per part. Only final inspection of part remains before packaging.

Other applications

This same process—or variations of it—is being used by the plastics industry to produce new decorating methods that save time and money. The spray-coating can be used as a mask, for example, in metallizing depressed areas, such as letters or numerals, while the background remains clear—the reverse of the process outlined above. Here a plug mask is pressed down into the depressions and the protective film is sprayed onto the exposed background.

When the plug mask is removed, the film remains on the background while the depressions are left clear for metallizing. After finishing, the film is blown off, leaving metallized letters on a clear background.

The dried film can be cut with a razor and peeled off specific areas—shapes such as letters or design motifs—exposing these areas for spray painting or metallizing. This technique is well suited to use with parts that are too large or cumbersome for die-cut masking (such as TV screens), or on prototype and model work where only a few parts are to be made.

Another advantage of the protective coating is the protection it affords clear surfaces of plastics parts against abrasion, dirt, and scratching during manufacturing, assembly, handling and shipment.

In the appliance field, for example, large pieces of molded plastic are often decorated on the inner surface while the outer surface remains clear. A sprayed-on protective film keeps the outer surface completely clean and unmarred through all operations from the molding machines to final assembly and shipment.

For maximum protection, the outer surface should be spray coated immediately after molding, as a secondary operation at the molding machine. Machining, drilling, sawing, assembling, packaging, and shipping can proceed without danger of scratching or chipping the protected surface. Use of the coating actually speeds these operations since workers no longer have to handle parts with the same degree of care; and packaging can be less elaborate.

Because the film is translucent, it does not hinder inspection. It can even remain in place until after delivery—to be removed by the customer—giving the manufacturer positive assurance that the surface of every part delivered is in perfect condition.—END

Fig. 3: After metallizing, masking film and accumulated overcoatings are stripped from face of speedometer dial with air jet, leaving dial clear and free of scratches

Fluidized polymer deposition

*By Robert L. Checkel**

The use of a fluidized air-agitated plastic powder bed as a means of applying protective coatings and as a general plastic fabrication technique has been investigated.[1] Equipment and techniques for applying such coatings over metallic substrates by this method are described. Several new concepts for plastic fabricating based on the fluidized bed principle are discussed.

Interest in the fluidized bed method of applying plastics was stimulated by information disclosed in a German patent issued in 1955 (1).[2] Both the patent and later American publications (3-7) dealt exclusively with the technique and equipment required for applying polymeric protective coatings. The work reported in this article was directed toward the characterization of the coatings thus produced as well as toward the development of the technique as a means of plastics fabrication.

Fluidized bed technique

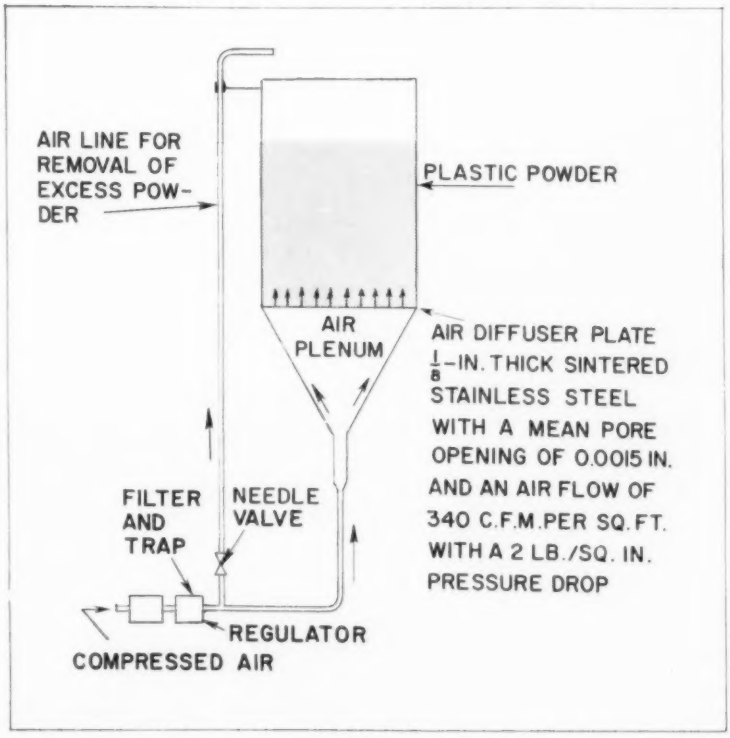
The fluidized bed technique consists of heating the object to be coated to a temperature above the melting point of the plastic, immersing the object in a bed of fluidized plastic powder; and, after removing it, allowing the residual heat in the object to fuse the adhering plastic particles into a continuous film. Although it is now a stock item, assembled equipment to accomplish the fluidization of a low-density plastic powder in an open chamber was not available at the time this study was initiated. A standard 6-in. stainless steel laboratory filtration funnel was modified and served as a fluidizing chamber. The general design and specifications for such a chamber are presented in considerable detail in Fig. 1, below.

Resins that had desirable coating characteristics but were not available as conventional paints were applied by using the fluidized bed process. Alathon G polyethylene resin, with a particle size range of 50- to 100-mesh, was the easiest polymer, among those tested, to apply by this technique. Other thermoplastic resins when reduced to the same particle size were also applied by this method. Each resin so applied and the results obtained will be discussed individually.

Protective coatings

Polyethylene: Using steel substrates and Alathon G resin fluidized with compressed air, a dense, homogeneous, inert coating was produced. By controlling the preheat temperature within the range of 275 to 375° C. and the exposure time of the hot substrate to the fluidized bed from 1 to 5 sec., coatings with a thickness range of 5 to 20 mils were obtained. The relationships between preheat temperature, exposure time, and coating thickness are given in Fig. 2, p. 126. Thicknesses in excess of those indicated in Fig. 2 are possible, but since economies dictate the use of minimum effective thickness,

Fig. 1: Fluidized chamber design


AIR LINE FOR REMOVAL OF EXCESS POWDER
PLASTIC POWDER
AIR PLENUM
AIR DIFFUSER PLATE 1/8-IN. THICK SINTERED STAINLESS STEEL WITH A MEAN PORE OPENING OF 0.0015 IN. AND AN AIR FLOW OF 340 C.F.M. PER SQ. FT. WITH A 2 LB./SQ. IN. PRESSURE DROP
FILTER AND TRAP
NEEDLE VALVE
REGULATOR
COMPRESSED AIR

*Engineering Research Laboratory, Engineering Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

[1]The basic processes of fluidized-bed coating are covered by U. S. Patent No. 2,844,489, assigned to Knapsack-Griesheim A. G. of Germany. Polymer Processes, Inc., Reading, Pa., is licensor for the U. S. and Canada. Pending patents cover some of the processes discussed in this research report.

[2]Numbers in parentheses link to references on p. 132.

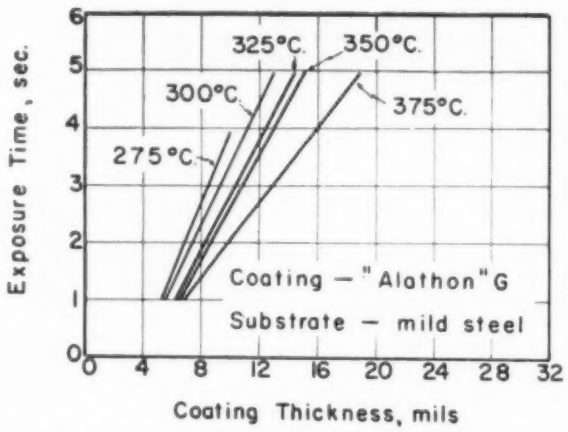


Fig. 2: Time, temperature, and coating thickness relations

formation of thicker films was not further studied.

Coating continuity as measured by an electrical resistance method (2) indicated that coating thicknesses of 8 mils and greater were void-free. Permeability failures were observed in some cases with coatings 8 mils and thicker; these were traced to sharp edges and projections on the substrate surface. Such failures are eliminated by grinding all sharp edges to a maximum radius.

Copper and aluminum, both possessing greater thermal diffusivity than steel, required preheat temperatures 45 to 50° C. greater than for steel to produce a polyethylene coating of the same thickness.

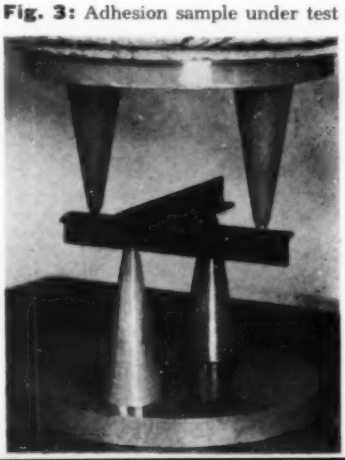
The minimum 8-mil coating thickness indicated for production of an impermeable coating was confirmed by corrosion tests. Steel specimens coated with 8 mils polyethylene by means of a fluidized bed were exposed to a variety of mineral acids, alkalies, and salts for 30 days at room temperature and 30 days at 50° C. These specimens were unaffected as evidenced by the absence of any underfilm corrosion.

Adhesion of a coating to its substrate is one of the more important properties of any protective coating system. Polyethylene applied over sandblasted steel surfaces required a 650 p.s.i. tensile stress to rupture the bond formed when the plastic served as an adhesive for two crossed pieces of steel (see Fig. 3, right). In all tests, the bond failure occurred within the plastic itself rather than at the plastic-to-metal interface, proving that the cohesive strength of the polymer was the weak link in the coating system. When degreasing was substituted for sandblasting as a surface preparation, the same phenomenon was observed. For most coating applications where abrasion factors are not involved, light wire-brushing followed by degreasing is adequate surface preparation for new or lightly rusted steel.

To test the integrity of both the polyethylene coating and its bond to steel, panels having 50% uncoated surfaces were subjected to liquid and vapor conditions promoting underfilm corrosion. No underfilm corrosion occurred within the 120-day test period, attesting to the apparent tightness of the coating bond.

Using plant personnel and field-constructed equipment, the fluidized-bed technique and the coatings produced were successfully field-tested in a typical industrial chemical plant. Parts such as pipe hangers and pipe flanges were coated with polyethylene and subjected to solvent vapors and sulfuric, hydrochloric, and hydrofluoric acid fumes. After one-year exposure the coated parts remain unaffected.

Fig. 3: Adhesion sample under test



To produce weather-resistant coatings, two types of carbon-filled polyethylene were investigated: 1) 4% by weight carbon black added to Alathon G polyethylene resin; and 2) Alathon 25 (2.5% carbon black incorporated in the resin) ground to 50- to 100-mesh particle size. Accelerated weathering tests were run to determine the degree of weather resistance obtained with films produced (as described below) from the two test powders. After 1000 hours of accelerated weathering, both coatings showed good weather resistance, as indicated by only a slight change in elongation and tensile strength during the test. Cold temperature brittleness was adversely affected, but the addition of antioxidants and the use of nitrogen as a fluidizing gas could shift this property into an acceptable range.

In addition to virgin and carbon-filled polyethylene, high-density polyethylene was also investigated. This material can be applied in the same manner as conventional polyethylene.

Polystyrene: Polystyrene molding powder was reduced to 50- to 100-mesh particle-size range by cold grinding. Under the same application conditions as those for polyethylene, a hard, transparent, brittle coating was produced over steel. On cooling, stress crazing occurred, thus producing a porous coating which is not suitable for chemical protection.

Nylon: Zytel nylon resin molding powder (50- to 100-mesh) fluidized easily without admixtures. Smooth coatings were obtained on steel and aluminum substrates by employing a multiple dipping technique where the final application was followed by a flame polishing which produced the desired surface smoothness. Coating thickness ranged between 0.010 and 0.015 inch.

Polymethyl methacrylate: Lucite acrylic resin coatings were also produced on steel by the fluidized bed technique, employing the same application condi-

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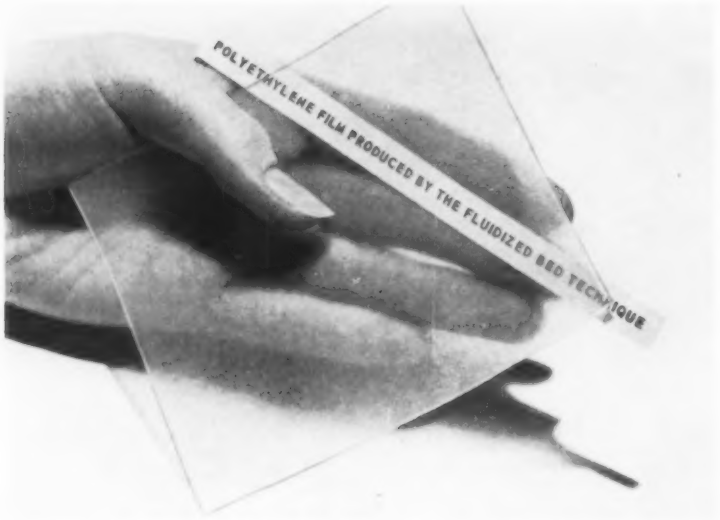

Fig. 4: Polyethylene film, 8 mils thick, was stripped from aluminum plate that had been dipped in fluidized polyethylene

tions as were used for poly ethylene. Hard, brittle, and transparent coatings were produced, which were similar physically to the polystyrene coatings.

Acetal resin: Coatings of Delrin acetal resin were applied over sandblasted steel panels that were preheated to 185° C. Specimens were dipped in the fluidized powder for 2 sec. and then post-fused at a temperature of 185° C. for 15 minutes. Thicker coatings were obtained by repeating these operations; a 10-mil coating required three cycles. Coatings produced by this technique have fair adhesion and fair toughness, but they are not as smooth as extruded acetal resin.

These coatings were also produced via an induction heating technique. Application factors remained the same except that induction heating was substituted for oven heating. The panel was inductively heated and then dipped into the fluidized bed and re-exposed in the electromagnetic field for several seconds to assure fusion of the resin.

All the previous acetal-resin coatings were characterized by a matte or dull finish. It was noted that while molten, the plastic had a good gloss that was lost as the resin slowly cooled. To reduce time-at-temperature and consequent resin degradation for the coated panel and to retain the gloss, the panel was water-quenched 45 sec. after the final resin fusion. Although some deleterious effects on adhesion were noted on water-quenched panels, coating toughness (as indicated by repeated flexing and creasing) and gloss were improved over the material produced with the slow cooling technique.

Fluorocarbon: Teflon FEP-fluorocarbon resin combines, to a significant degree, the desirable properties of TFE resin with a melt viscosity approximately one-millionth as great. This material was successfully applied over steel using the fluidized bed process, although several technique modifications were necessary. Panels were sandblasted and preheated in an oven to 350° C. Teflon FEP powder was placed in the fluidizer and the entire unit then placed on a laboratory shaker. The oscillatory movement was necessary to prevent channeling of air through the resin which would have resulted in poor fluidization. The preheated substrate was immersed in the bed, removed, and post-fused at 350° C. This operation resulted in a coating 4 mils thick. The entire procedure was repeated four times and a smooth, dense, 10-mil coating was produced. Strip tests indicate adhesion to be far superior to that which would be expected for a material of the fluorocarbon type, which has well-known antistick and non-adherent characteristics. Bond strength was achieved that exceeded the cohesive strength of the film. Additional evaluation continues on this development.

Unsupported films

Unsupported film can be made by extending the fluidized bed technique for the application of protective coatings to a system in which the polymer layer can be easily stripped from the substrate. An aluminum plate, lightly coated with silicone grease, was preheated to 400° C., immersed for three 3-sec. intervals in a fluidized bed of Alathon G polyethylene, and upon removal from the bed allowed to cool to room temperature. The coating, when stripped from the substrate, was a sheet of polyethylene film 8 mils thick (see Fig. 4, left). Polishing substrate surfaces might eliminate need for a release agent.

Preliminary physical testing indicated that, when compared to extruded polyethylene, film produced from a fluidized bed had a lower elongation and slightly higher tensile strength. In thin films, below 8 mils, some porosity was noted. This is desirable in some end uses where the film is required to breathe, though not, of course, in protective coatings.

As a result of the preliminary film work, a possible design for the production of unsupported polyethylene by the fluidized-bed technique was suggested. This design would utilize a rotating super-smooth metallic casting drum whose outer surface could be heated or cooled where desired. The drum could be posi-

Fig. 5: Polyethylene-coated fabric

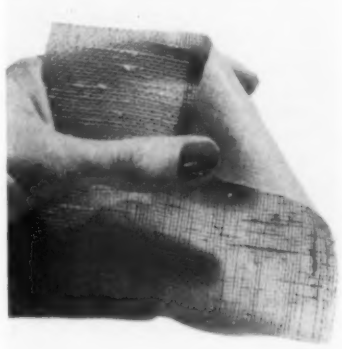

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Fig. 6: Induction heated continuous wire coater

tioned and continuously rotated in such a way to present a portion of its surface to a fluidized solids bed. As the drum rotates and heat is applied to the segment of the wheel over the bed, the plastic would fuse. The fused plastic could then be rapidly cooled and, as the drum rotates, the film could be continuously removed by a doctor blade. In an alternative set-up, a continuous belt made from flexible metallic or heat-resistant plastic could also be used as a substitute for the drum. If a textured or patterned surface is desired, such as simulated leather, the drum surface could be so prepared. A patterned nip-roll could ride over the fused plastic if the pattern were desired on both sides. In this case, a release agent would be employed to prevent adhesion.

The potential advantages of this technique in film forming are: 1) low capital investment, and 2) isotropic properties of the film, since no extrusion orientation is produced. In this connection, preferred orientation and directionality of properties could be subsequently induced.

Fig. 7: Reinforced polyethylene made from pre-coated glass fiber

Coated fabrics

A natural extension of the unsupported film work was the production of coated fabric. Although at least two approaches were possible—1) transfer of a plastic melt to fabric, and 2) coating of heated, thermally insensitive fabric by dipping into a fluidized bed —our laboratory work was devoted to the first of these approaches. Coated fabric was experimentally produced by starting in the same manner as for unsupported film. However, immediately upon removal from the fluidized bed, while the plastic was still molten, a woven fabric was pressed into the semi-liquid material. The low melt viscosity of the polyethylene permitted the cloth to embed itself in the plastic, where it was set as the plastic cooled. Upon removal from the substrate, a one-sided coated fabric was obtained (see Fig. 5, p. 128). Both glass and cotton cloth were used.

This technique could be scaled up to a continuous process by using the same basic casting drum design described for film production. In addition, a web of fabric could be applied on the drum in the area where the plastic is fluid, brought up around a 90° arc of the drum and under a take-off roll. By applying tension to the coated fabric at point of take-off, the fabric would be impressed into the molten plastic.

Coated filaments

Glass fiber: A continuous process for applying plastic coating over glass fibers by the fluidized bed approach was demonstrated. The glass filament was pulled from a spool through a constant-tension device. From this the fiber proceeded to a ceramic-barrel radiant heater which preheated the fiber to 400° C. It then passed through a fluorocarbon bushing and into the fluidized bed. The fiber retained sufficient heat to attach plastic particles but not to fuse them.

Post-fusion was carried out in a ceramic-tube radiant heater placed above the bed and operating at 200° C. to fuse the plastic into a dense coating. The coated fiber was taken up on a variable-speed spool. Alathon G polyethylene, Zytel nylon, and polystyrene resins were thus applied. Resin pickup, based on glass fiber weight, varied between 40 to 110 percent. The nylon and polystyrene coating were brittle and cracked easily. Polyethylene-coated fiber remained flexible.

Metallic wire: A natural follow-up on glass-fiber coating is the continuous application of polyethylene electrical insulation over metallic wire. The same equipment detailed for glass-fiber coating was used. This resulted in polyethylene coating over 18-, 20-, and 22-gage copper and steel wire. The coating thickness was varied from 5 to 15 mils by changing preheat temperature and fluidized bed height. The coating, however, was not as smooth as extruded coatings. This was due to an uneven accumulation of plastic powder on the hot wire as it entered the fluidizing chamber.

The principle of induction heating was employed to overcome this problem. The heating coil was placed and the wire heated within the fluidized bed, permitting the wire to enter the unit unheated. The induction-heated continuous wire coater is seen in Fig. 6, above. This produced a much smoother polyethylene coating with thickness up to 20 mils. Throughput rate in the laboratory was 6 ft./min. and no post-fusion was required. The speed of application using induction heating is unlimited.

Polyethylene wire coating produced from a fluidized bed has a greater adhesion to copper wire than that produced with conventional techniques for wire insulation. However, it was still possible to strip it from the wire using conventional electrician's tools and techniques. Adhesion can be destroyed, if desired, by greasing

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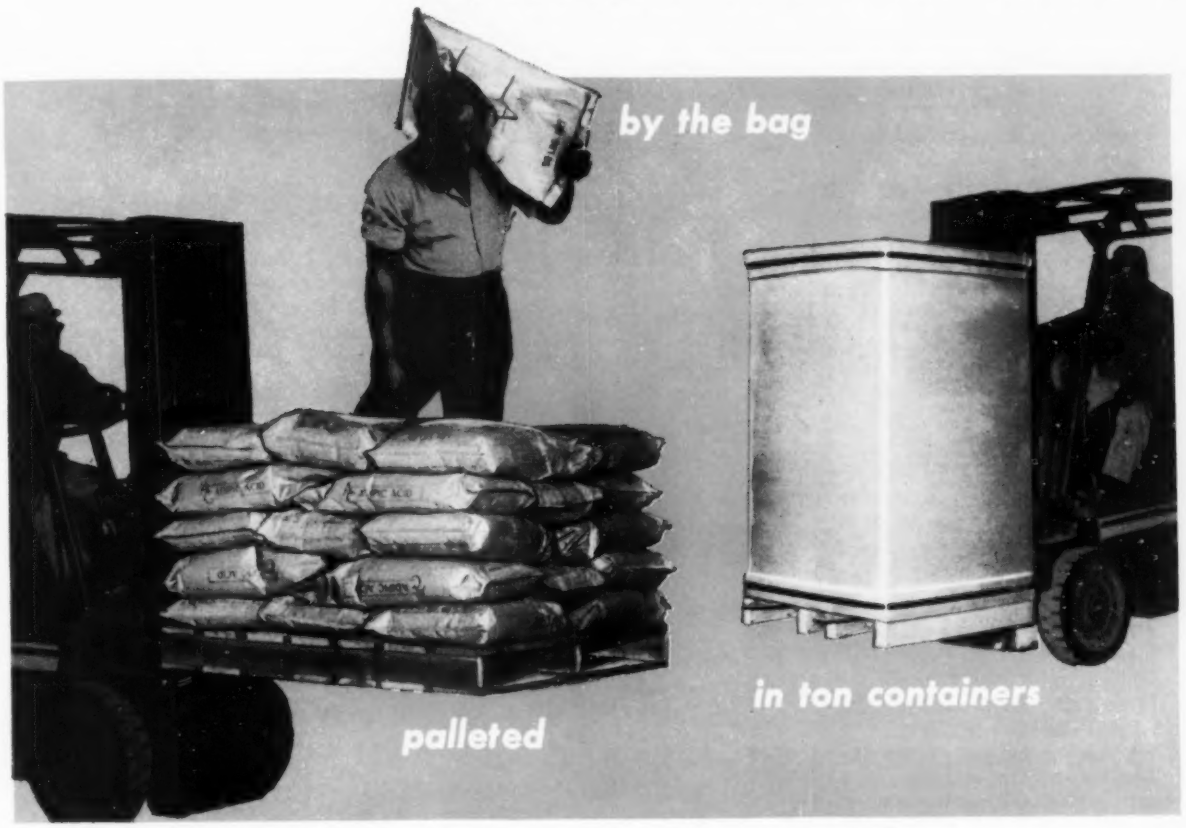

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the wire prior to coating. In addition, air entrapment in the plastic can be varied to produce a material approaching formed polyethylene in structure. It is speculated that thermally activated blowing agents incorporated in the powder could also produce a cellular product.

By substituting finite lengths of metal pipe for the continuously fed wire, this induction heating and coating technique could be used for pipe coatings and linings.

One advantage of this fluidized bed process over extrusion coating techniques for wire is low capital investment, since a small fluidizing chamber could contain a large number of wires being simultaneously coated.

Reinforced plastics

Coated staple: A reinforced polyethylene was produced using polyethylene-coated glass fiber prepared as described above. The coated fiber was cut in short lengths ranging from ¼ to ¾ inch. This chopped staple was pressed in a mold at 180° C. temperature and 3 p.s.i. pressure. The resulting fused, reinforced sheet is seen in Fig. 7, p. 130. This technique provided a controlled, uniform glass fiber-to-plastic proportion and distribution.

Wire screen embedding: Another method for producing reinforced plastics by the fluidized bed technique consisted of shaping a wire screen to a desired finished form such as pipe, trough, duct, I-beam, channel, etc. This wire preform was then heated to 400° C. and immersed in a fluidized bed for 2 to 4 seconds. Since the heat capacity of wire screen is low, post-heating at 150 to 180° C. was required to melt the adhering powder. This process was repeated two to four times, except that the 180° C. post-heating replaced preheating. With final fusion the wire screen was completely filled in and embedded in the plastic (see Fig. 8, above), and consequently, reinforced it. A section of 2-in. pipe made in this manner and tested for burst strength indicated that the burst strength was approximately 10 times that of unreinforced polyethylene pipe of the same wall thickness.

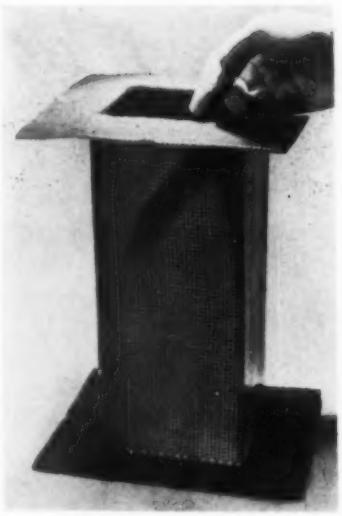

Fig. 8: Metal wire-reinforced polyethylene duct produced by the fluidized bed technique

The use of induction heating can potentially make this technique a continuous, practical means of making reinforced plastic by eliminating the re-heating cyles. In place of screen, wire could be continuously braided over a mandrel and the braided tube fed through an induction heating coil immersed in the fluidized bed. Preliminary discussion and estimates indicate that the cost of reinforced polyethylene pipe made in this manner would be competitive with polyvinyl chloride pipe of equivalent strength.

Unique applications

Described below are two unique applications in which the fluidized bed technique was used where other approaches were unsuccessful, impossible, or undesirable.

Polyethylene over nylon: A waterproof coating over molded nylon bottles was required to prevent moisture migration through the walls. Polyethylene was the best candidate but was not available as a coating. Normal preheat in the 300 to 400° C. range required for fluidized bed application was obviously not possible with nylon. In this case, the bottle was filled with sand to provide an enlarged heat sink. The filled bottle was heated to 150° C. and then immersed in a fluidized bed of polyethylene resin. It was again placed in the oven and post-fused. This was repeated two to four times until a coating thickness greater than 8 mils had been built up. Tests showed that the coating provided the necessary barrier to water migration with no apparent embrittlement of the nylon due to the processing method.

Dry-powder-spraying: A modification of the fluidized powder bed approach resulted in still another method of applying thermoplastic coatings. Polyethylene resin was placed in the material cup of a spray gun designed to apply flocculated materials. The spray gun, using compressed air, was then triggered, producing a spray of powdered plastic particles. This spray was directed over the surface of a panel which was preheated to 400° C. When the surface was completely covered, spraying was halted until the powder fused. Supplemental coats were applied in the same manner to build up the required coating thickness. This technique is useful for coating objects larger than can be handled by existing separate fluidizing chambers.

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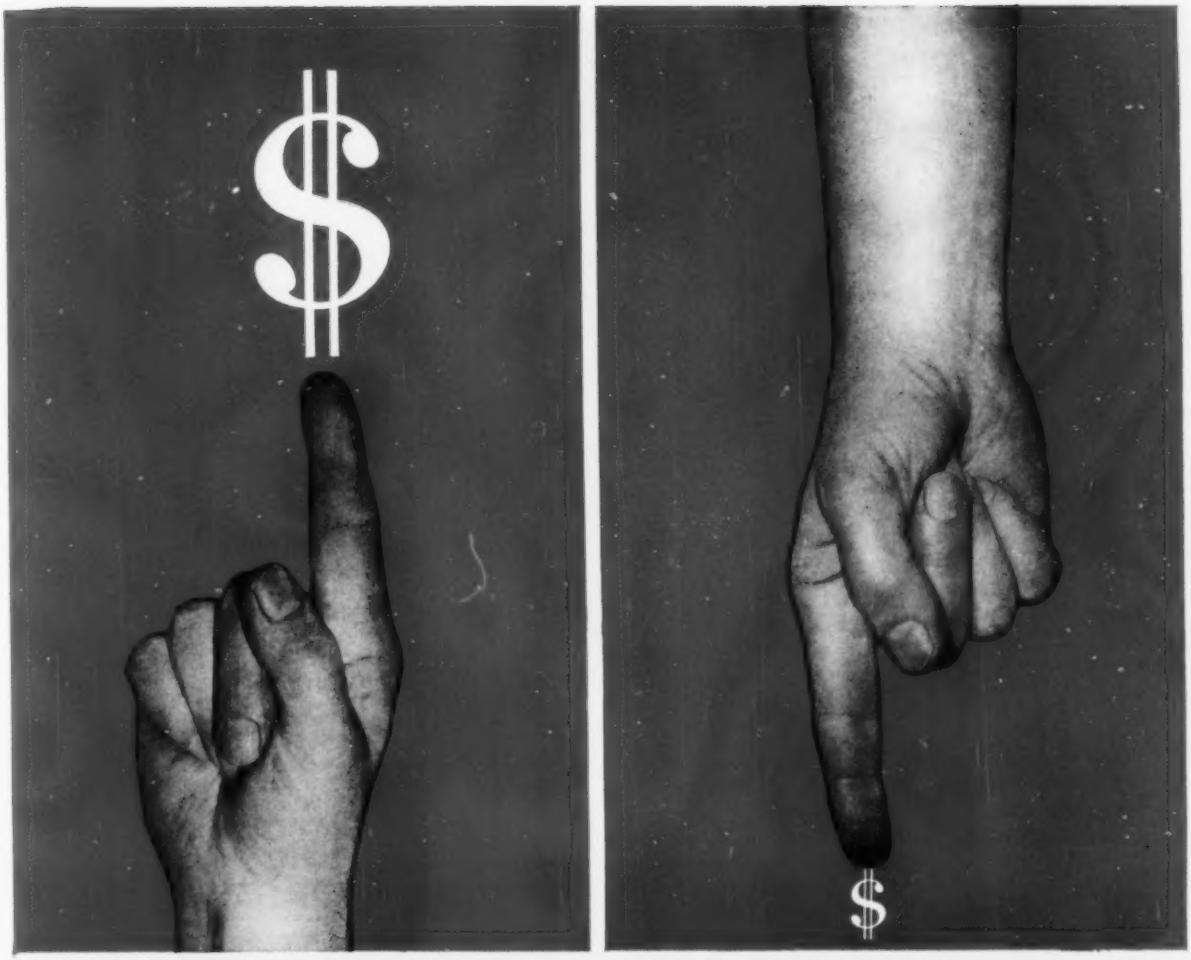

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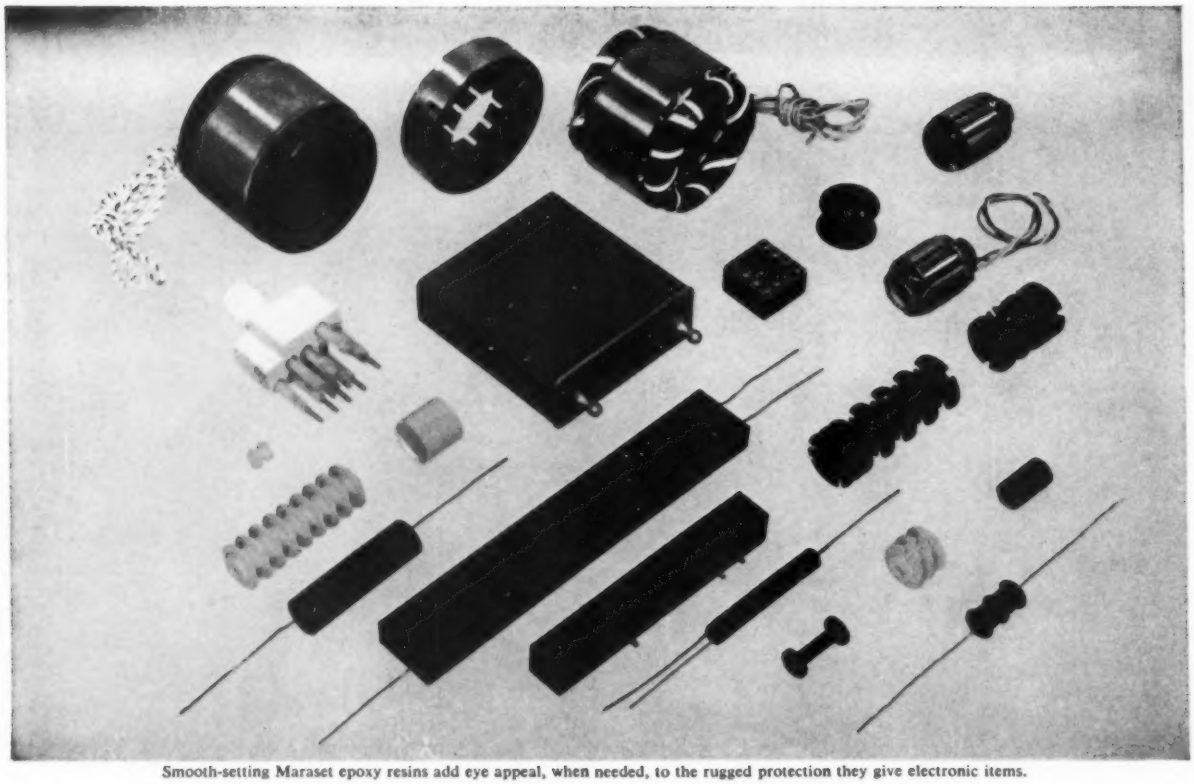

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Plastics Technical Section

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Effect of small quantities of plasticizers in PVC compounds

By P. Ghersa†

It is well known that both straight polyvinyl chlorides, which are more generally used in European countries, and copolymers with vinyl acetate and vinylidene chloride, more frequently used in the United States and United Kingdom, need the addition of substances to ensure good flow properties during processing. One simple way of improving the flow properties is to add small quantities—not more than 15 to 20%—of plasticizers which, while they considerably lower the viscosity of the molten material, do not substantially influence the rigidity of the finished product at room temperature. It was, however, soon discovered that lightly plasticized compounds are, contrary to the general belief, more rigid and brittle at low temperature than unplasticized ones.

Only a few references on this subject are to be found in the literature (1,2),[1] although a number of reports exist on the effects of different plasticizers on the mechanical properties of polymers and copolymers in the high concentration range, and on the theoretical explanation thereof. The author has previously reported on the first phase of the investigation described in this paper. (3).

*Reg. U.S. Pat. Off.
†Pirelli S.p.A., Milan, Italy.

[1]Numbers in parentheses link to references at end of article, p. 212.

Test procedures

Tensile strength, elongation at break, and modulus of elasticity in tension were determined according to A.S.T.M. D 632, using a Tinius Olsen Plastiversal testing

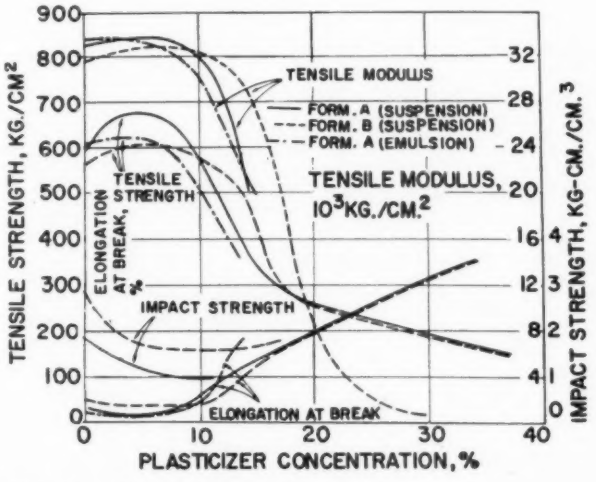

Fig. 1A: Mechanical properties of plasticized PVC compounds (suspension and emulsion polymers) versus plasticizer concentration at 23° C.

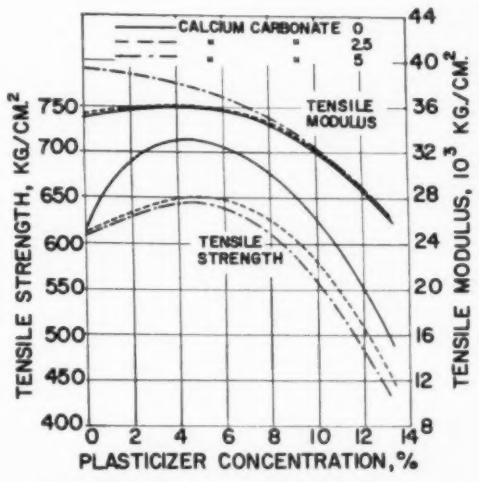

Fig. 1B: Tensile strength and modulus of plasticized PVC compounds, with different amounts of filler, versus plasticizer concentration at 23° C. (Formulation A suspension polymer)

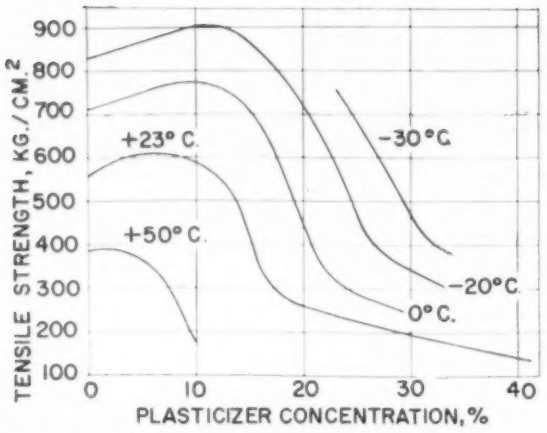

Fig. 2: Tensile strength at different temperatures versus DOP plasticizer concentration. (Formulation B)

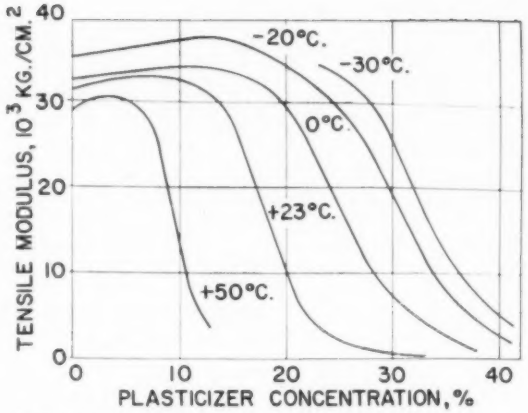

Fig. 3: Tensile modulus of elasticity at different temperatures versus DOP concentration. (Formulation B)

machine. The tangent modulus at the origin was obtained from the graphs recorded with an electronic extensometer. Charpy impact strength notched and unnotched was determined according to DIN-53453 and ISO TC/61 WG 2 Draft Proposal 1955. The test specimen was 4 by 10 by 80 mm., span 64 millimeters.

Test compounds were prepared with a straight vinyl chloride polymer, suspension polymerized (Sicron, of SIC Edison, Milan, Italy) and di-2-ethylhexyl phthalate (DOP) with two different formulations as follows:

Formulation A	
PVC	100 parts
Stabilizer (Advastab 17 M)	2
Stearic acid	0.5
DOP	X
Formulation B	
PVC	100 parts
Basic lead carbonate	2
Lead stearate	2
Calcium stearate	1
DOP	X

These formulations were chosen in order to have, on the one hand, only perfectly compatible ingredients, and therefore a homogeneous and transparent stock (formulation A) and, on the other, a system containing an insoluble stabilizer as a heterogeneous phase (formulation B).

Effect of plasticizer content

Figure 1A, p. 135, shows the variations of the tensile strength, tensile modulus, elongation at break, and impact resistance with the plasticizer content, calculated as a percentage of the total amount of resin plus plasticizer. Very distinct maxima in the curves of tensile strength and modulus are observed at a plasticizer concentration of 5 to 10%; in the plots of impact strength and elongation at break corresponding minima occur.

It was observed that unnotched specimens did not break or, at lower temperatures, broke with high scattering of impact strength values. Notched specimen with a sharp-edged notch such as the DIN specimen, gave very reproducible results, but they did not show much difference between the various compounds. The best results were obtained with specimens having a rounded notch of 1-mm. radius or with an ISO notch of 60° and a radius of 0.2 millimeter.

The impact strength curves shown in Fig. 1A were obtained with notched ISO specimens. The values of the breaking energy in kg./cm. are referred to the volume in cm.³ of the part of the specimen between the supports. In all cases a minimum of impact strength was found at a plasticizer concentration in the same range as that in which the maximum in

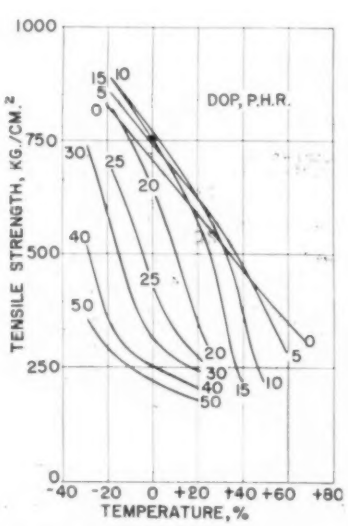

Fig. 4: Tensile strength at different plasticizer concentrations versus temperatures. (Formulation B)

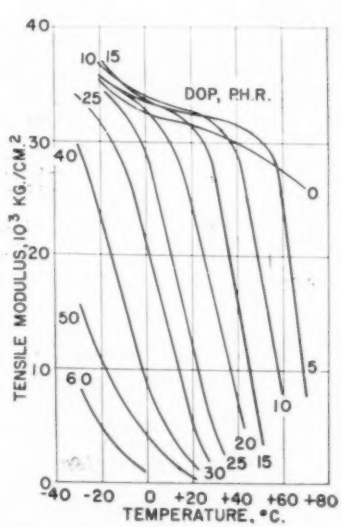

Fig. 5: Tensile modulus of elasticity at different DOP concentrations versus temperature. (Formulation B)

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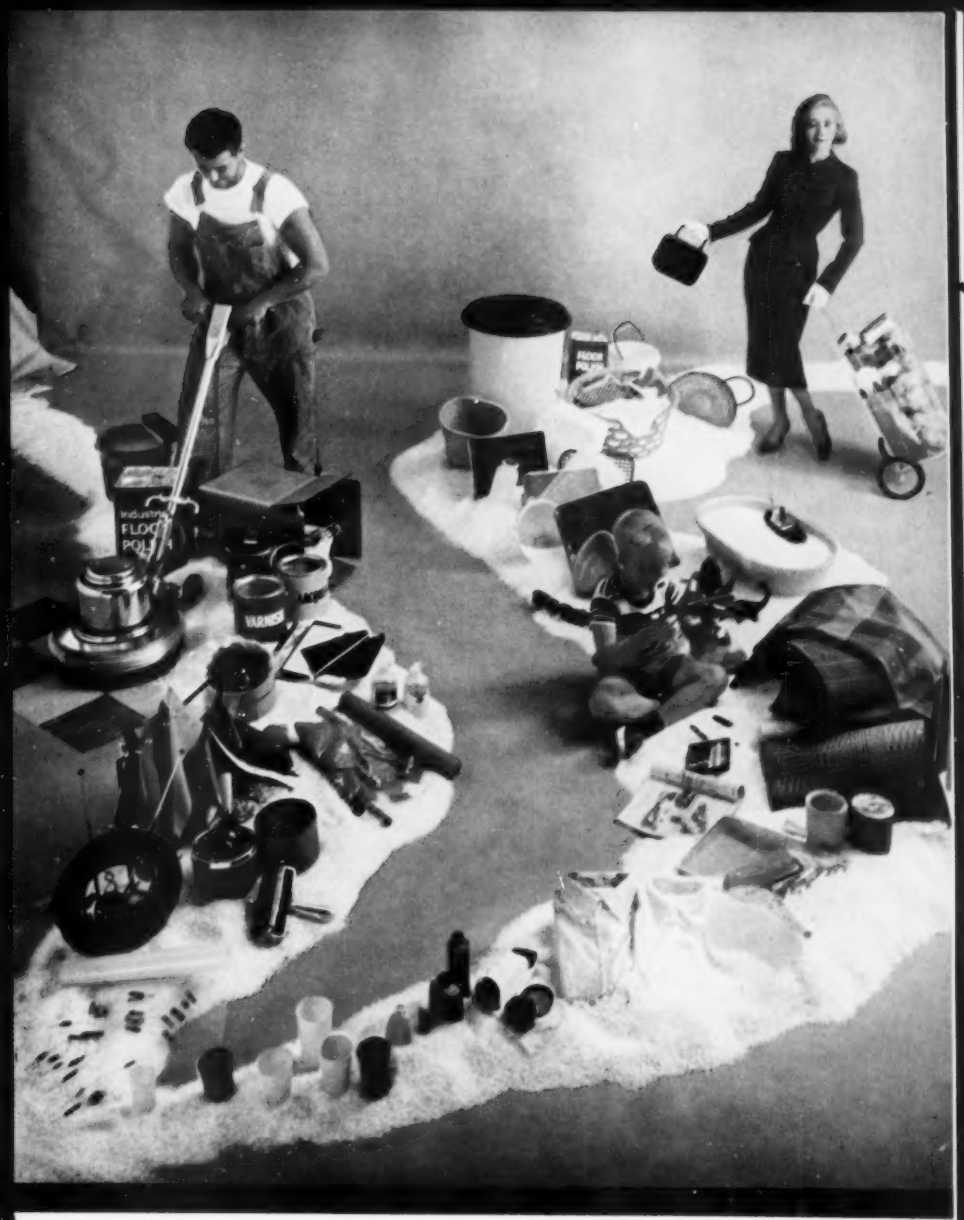

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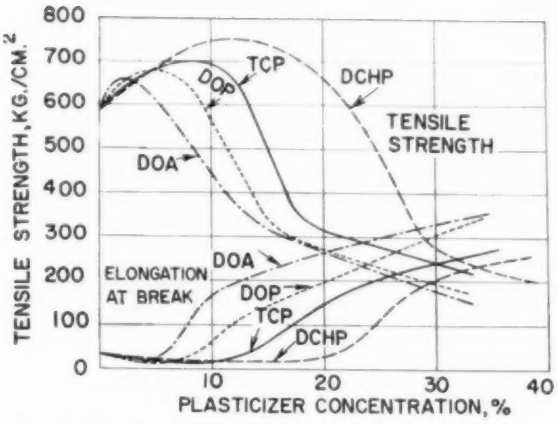


Fig. 6: Tensile strength and elongation at break versus plasticizer concentration for different monomeric plasticizer at 23° C. (Formulation A)

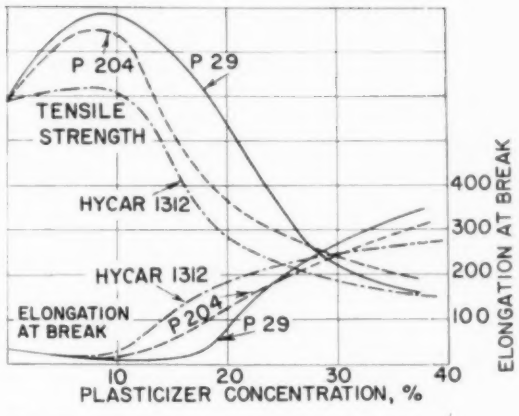


Fig. 7: Tensile strength and elongation at break versus plasticizer concentration for different polymeric plasticizers at 23° C. (Formulation A)

modulus and tensile strength was obtained; therefore, owing to the lesser sensitivity of the impact test, only tensile strength, modulus, and elongation will be considered in the following discussion.

Referring to Fig. 1A, it was also observed that the maxima in modulus and tensile strength and the minima in elongation are more pronounced in the completely homogeneous compound. It was also observed that in such compounds the impact strength values are lower than in compounds containing insoluble lead stabilizers, even in completely unplasticized samples.

Behavior of different polymers

In order to ascertain whether the above phenomena are of a general nature, different straight PVC polymers were examined, both of the suspension and of the emulsion type, including the paste-forming grades in very fine powdered form, which are generally considered as being unreliable for the manufacture of rigid PVC. These included polymers of four manufacturers, three Italian and one American. The behavior of the different polymers was substantially the same. The peaks in the modulus and tensile strength curves were, however, much more pronounced in the case of suspension polymers (see Fig. 1A).

The behavior of the compounds prepared with emulsion polymers according to formulation A is very similar to that of the compounds prepared with suspension polymers and formulation B; i.e., the highest maxima in tensile strength and modulus occur always with homogeneous, transparent stocks, whereas a flattening of the curves is observed in the case of materials containing a heterogeneous phase, either due to insoluble stabilizers or fillers (Fig. 1B, p. 135) added to the compound or from the substances originally contained in the polymerizing emulsion. All the compounds showing the more flattened tensile strength and modulus curves give a non-transparent stock when molded.

No systematic work was done in our laboratory with copolymers. However, their behavior was found to be very similar to that of straight PVC resins, in agreement also with the work done by Weldon (1) and Horsley (2).

Variation of mechanical properties with temperature

The variation of the mechanical properties with temperature in the range from −30° to 50° C. for formulation B is shown in Figs. 2 and 3, p. 136. The peaks in the tensile strength and modulus curves take the direction of lower plasticizer concentrations when the temperature increases. At −20° C. the tensile strength maximum occurs at about 10 to 12% DOP, whereas at 50° C. the maxi-

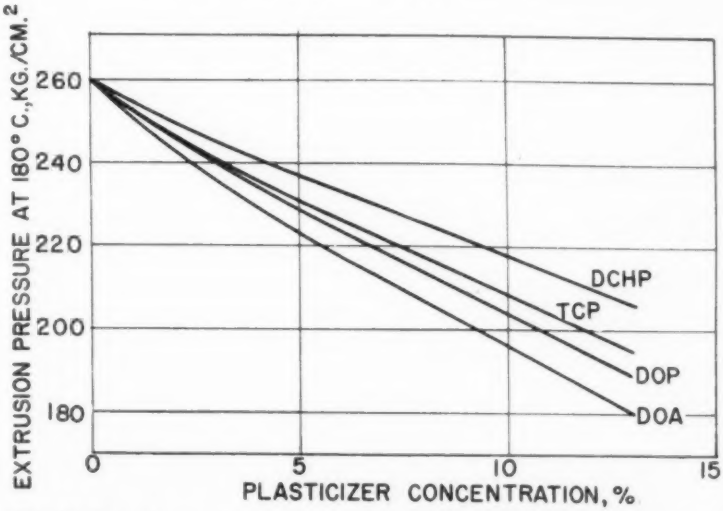


Fig. 8: Extrusion pressure at 180° C. for PVC with different plasticizers versus plasticizer concentrations. (Formulation B)

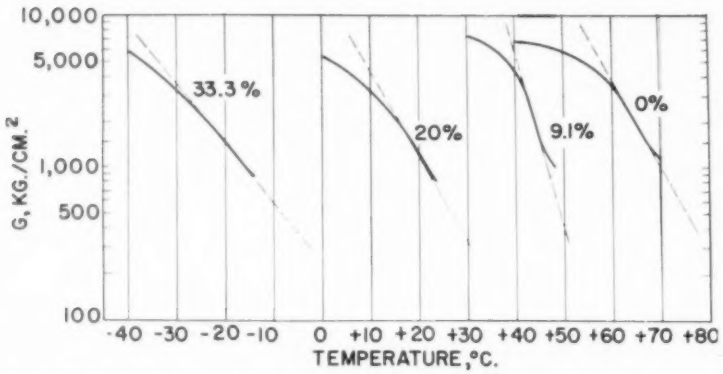


Fig. 9: Clash-Berg torsional moduli at different plasticizer (DOP) concentrations versus temperature. (Formulation A)

mum tensile strength is essentially obtained with the unplasticized compound.

In Figures 4 and 5, p. 136, tensile strength and modulus are plotted versus temperature for different plasticizer concentrations. The strengths and moduli of lightly plasticized compounds at low temperatures are higher than those of compounds containing either no plasticizer at all or large percentages of plasticizers. The graphs also show that the slope of the modulus-temperature curves are steeper in the range of 5 to 15% plasticizer content. A similar behavior was found in the torsional moduli recorded with the Clash-Berg method.

Comparison of different plasticizers

Compounds containing different amounts of a series of monomer and polymer plasticizers were prepared on the basis of formulations A and B with the suspension polymer "Sicron CT." The plasticizers used were as follows:

Di-2-ethylhexyl phthalate (DOP)
Di-2-ethylhexyl adipate (DOA)
Di-2-ethylhexy sebacate (DOS)
Di-2-ethylhexyl diphenyl phosphate (Santicizer 141) (Monsanto)
Trioctyl phosphate (TOF)
Triphenyl phosphate (TPP)
Tricresyl phosphate (TCP)
Di-cyclohexyl phthalate (DCHP)
Mesamoll (Baeyer)
Paraplex G 60 (epoxylated soyabean oil) (Rohm & Haas)
Plasticizer P-204 (adipic polyester)
Plasticizer P-29 (phthalic polyester)
Plasticizer P-206 (epoxy-type ester, high molecular weight) (Oel Chemie Werk A.G.)
Hycar 1312 (liquid butadiene-acrylonitrile polymer) (Goodrich)

In all cases similar curves for tensile strength and elongation at break were obtained, with a maximum and a minimum, respectively, in the range of 5 to 15% plasticizer content, although the position, the absolute value, and the width of the minimum and maximum vary with the different plasticizers. The curves of tensile strength and elongation for four monomer plasticizers, having a well differentiated behavior, are shown in Fig. 6, p. 139. The curves of some polymer plasticizers of the polyester type and of a butadiene-acrylonitrile copolymer are shown in Fig. 7, p. 139. The concentration of plasticizer corresponding to the peak in the tensile strength curve will in the following discussion be called the "critical concentration."

Relation between critical concentrations and efficiency

An attempt has been made to find the correlation between the critical concentration values and other characteristic properties of the plasticizers that could be taken as an index of their plasticizing action or "efficiency." First the lowering of the melt viscosity at high temperatures (180° C.) was checked for different plasticizers. Figure 8 p. 139, shows the extrusion pressure versus plasticizer concentration for four plasticizers (DOP, DOA, TCP, DCHP) measured with a constant rate of extrusion plastometer of the Hayes type (4). The melt viscosity values at a given plasticizer concentration are considerably lower in the case of plasticizers such as DOA and DOS, which have a lower critical concentration.

Then it was found that much more reliable and accurate results could be obtained by the determination of the "second order transition" temperature. A method based on measuring the change of the torsional modulus with the temperature was employed, according to the Clash-Berg test (A.S.T.M. D 1043-51T). The curves of the torsional modulus versus temperature on a semilogarithmic graph have an inverted "S" shape. The slope of the curve increases rapidly in the second order transition zone and presents a flexure. This flexure

Fig. 10: Tf versus plasticizer concentration. (Formulation A)

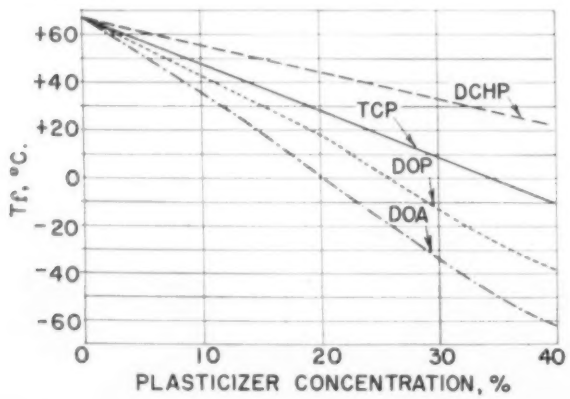
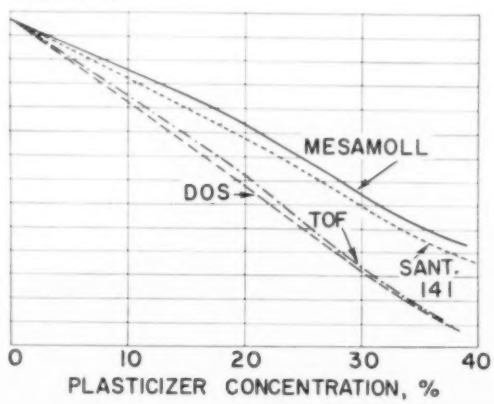
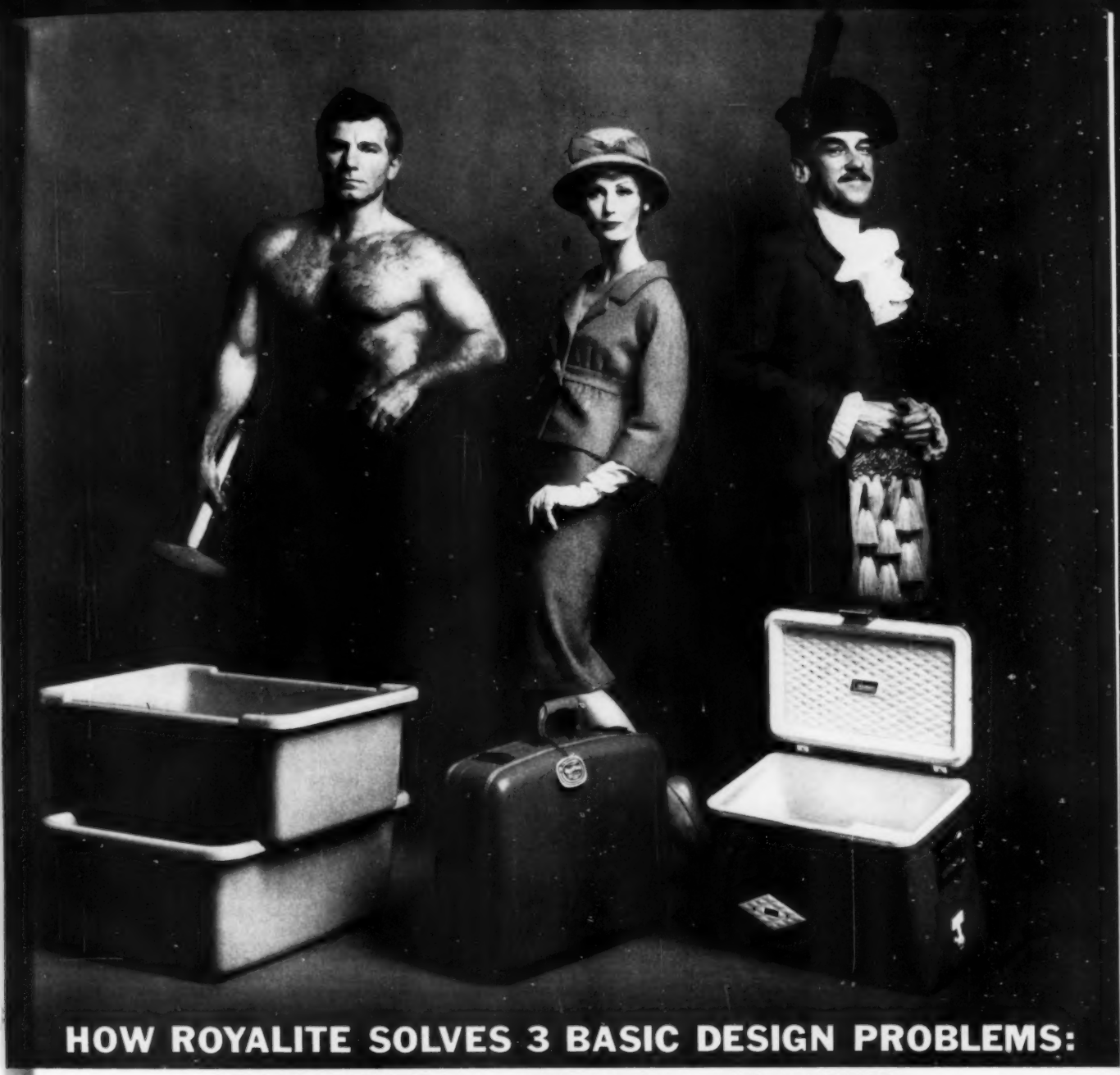


Fig. 11: Tf versus plasticizer concentration. (Formulation A)





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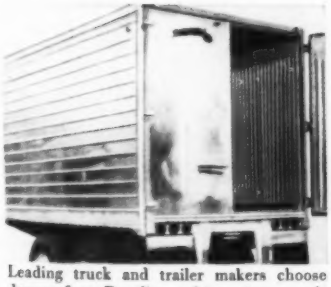

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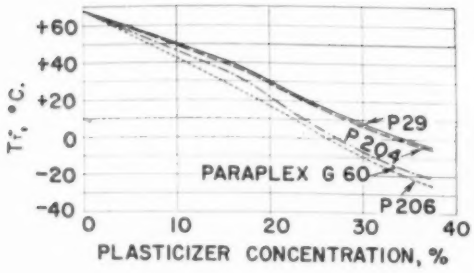


Fig. 12: Tf versus plasticizer concentration. (Formulation A)

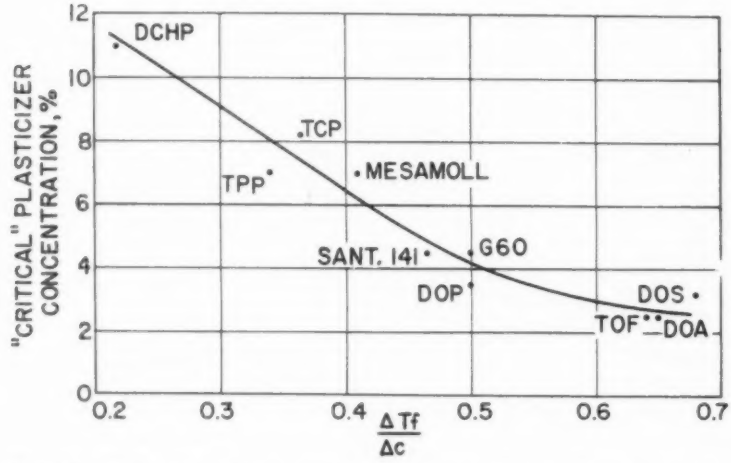


Fig. 13: "Critical" plasticizer concentration versus ΔTf/Δc (Formulation A)

point is defined by the temperature—corresponding to the maximum slope [S=(d log G/dt)] of the curve (5).

In Fig. 9, p. 140, a family of G=f (T) curves for various plasticizers concentrations in the PVC-DOP system is reported. As Tm in all cases falls within the range 1500 to 2000 kg./cm.², and as the curves are very steep in this range, a conventional Tf (cold flex temperature), instead of the true transition temperature Tm, was assumed in correspondence with a G modulus of 1670 kg./cm.², according to the work of Hayes and Lannon (6).

Tf is plotted versus plasticizer concentration in Figs. 10 and 11, p. 140; Fig. 12, above. All the curves have a practically linear behavior up to 40 to 50% plasticizer content. The slope of the curves may be an index of the plasticizing efficiency, i.e., at the same concentration the transition temperature is lower for more efficient plasticizers.

In Fig. 13, above, the "critical" concentrations of the plasticizers (in compounds with the same polymer and formulation) are plotted against the values of the slope of the corresponding curves Tf=f(c). It can be seen that the values of the critical concentration follow a well-defined continuous curve—from 11% of DCHP to 2 to 3% of DOS, DOA, and TOF. It was further observed in graphs of log G=f(T) that the slope of the curves at Tm presents a maximum at a plasticizer content corresponding exactly or, at least, approximately to the critical concentration determined in the tensile tests.

Discussion

There is evidence that the described anomaly in the behavior of plasticizers in lightly plasticized PVC compounds occurs with all polymers and copolymers of the vinyl chloride group, and with all the plasticizers so far examined by the author and by others. It can, therefore, be considered of quite a general nature.

It is clear, too, that the true plasticizing action of plasticizers —in the common meaning of the word, which is the weakening of the second order (Van der Waals) attraction forces between the polymer chains because of the interposition of the plasticizer molecules and of the screening of the polar groups—takes place only beyond a well-defined "critical" concentration. Below this value, which for a given polymer-plasticizer system is dependent on the temperature, the effect of the plasticizer is to enhance the intermolecular attraction.

According to the recently proposed explanation of Horsley (2) the maximum in tensile strength and rigidity is to be attributed to the increase in the degree of order, or even of the crystallinity, of the system. The orientation of the macromolecules is likely to be rendered easier by the addition of small amounts of plasticizers, and in the region where several straight segments of PVC chains become parallel, crystallization may take place. Inside the crystallites the cohesion forces are always considerably higher than in the amorphous region, as in the case of the more crystalline polymers, such as polyethylene, polyamides, PVC's, etc.

This theory is favored, according to Horsley, by the X-ray diffraction patterns, which show the presence of a definite degree of order, having a maximum in compounds with critical plasticizer concentration. It is also supported by the experimentally demonstrated possibility of reducing the rigidity and brittleness of the critical compounds by heating them above their softening point and quench cooling. The quenched

(*To page* 212)

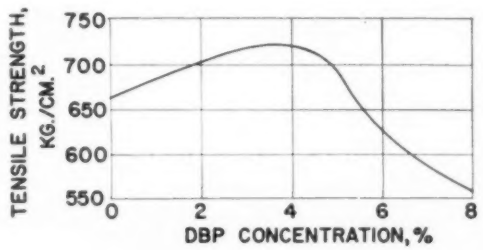
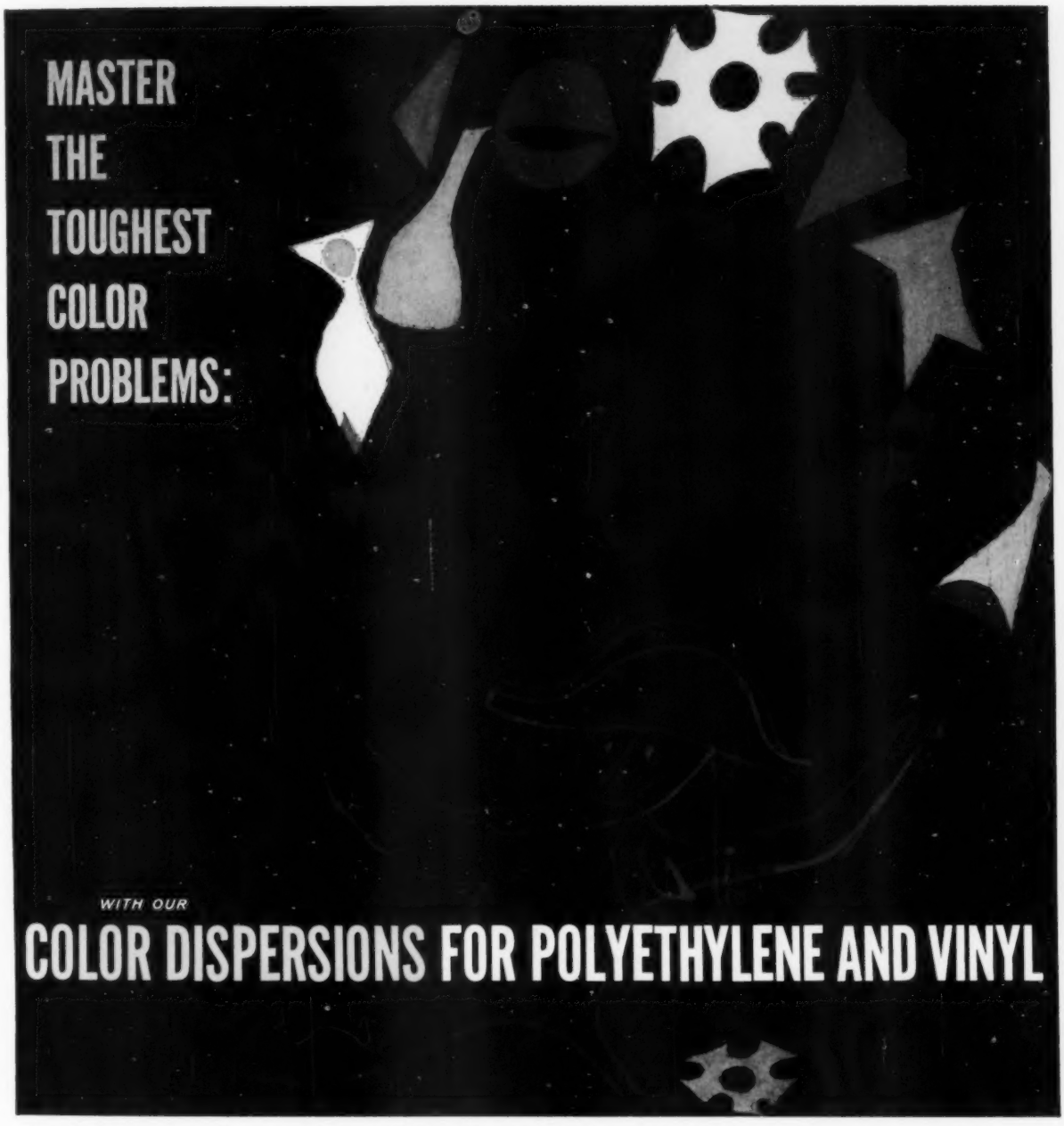


Fig. 14: Tensile strength of plasticized polymethyl methacrylate vs. DBP concentration



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Application of Larson-Miller correlation to

Service test data on high-density polyethylene

*By W. E. Gloor**

The discovery of simple means of making high-density polyethylenes and the subsequent investigation of the properties of these materials, has led to the assumption by many people that these would be ideal materials for the production of plastic pipe. This conclusion was reached because of the good resistance to chemicals at high and low temperatures, and the physical properties such as tensile strength, modulus of elasticity, and impact strength of the high-density material, together with a price ranging in the lower spectrum of those at which plastic materials are generally offered. As a matter of fact, L. Berti and E. Bua (1)[1] published short-time bursting strength values on pipe made abroad from linear polyethylene of density about 0.95, which indicated that the short-time bursting pressures taken by this material at 75° C. were equivalent to those for the low-density or branched-chain type of polyethylene measured at about 30° C.

The commercial production of high-density polyethylene began in Europe about two years ago, and at once a small market developed for the material for use in pipe.

Various German municipal water authorities showed a great interest in pipe made of high-density polyethylene, especially for such uses as connecting water mains to houses, and installation of service lines beneath plaster in buildings. Once preliminary testing had shown that it was quite feasible to make such connections in accordance with established practice, the manufacturers of the pipe made with high-density polyethylene were called upon to furnish guarantees that the material would withstand 150-lb. line pressures at 20° C. over a period of 50 years. It soon became evident that the lower-molecular-weight polymers, which were normally used for injection molding and some types of extrusion, would not enable such a guarantee to be given.

A variety of pipe formulation based on a somewhat higher-molecular-weight material, which still gave good extrusion rates, was developed by Farbwerke Hoechst AG. This enabled them to make such guarantees, the basis of which was recently presented to an American audience by K. Richard of the Hoechst organization (2). The course of these developments has also been discussed by other personnel of Farbwerke Hoechst (3). The information disclosed by Dr. Richard is summarized in Fig. 1, below, which shows curves giving the minimum breaking time for pipe made from this higher-molecular-weight material at various temperatures. Since only about two years' testing time is involved in these curves, the times up to 50 years are based upon extrapolations, the detail of which was discussed by Dr. Richard. Upon seeing this Hoechst information, it became apparent to us, following the work of Underwood (4), that a Larson-Miller type of correlation (5) could be applied to these curves throughout their entirety, and an independent evaluation made of the validity of these predictions.

Application of Larson-Miller correlation to data developed by Hoechst

The key of the Larson-Miller correlation is that a plot of strength against a parameter, on semi-log paper where the strength is plotted on the log axis, gives a straight line. The parameter may

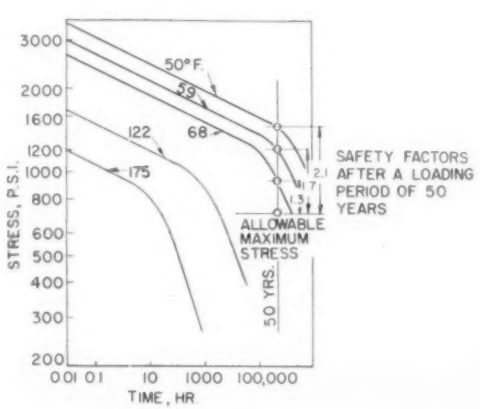

Fig. 1: Long-time pressure tests on pipes made of high-density polyethylene. (Based on data from K. Richard)

*Hercules Powder Co.
Paper presented at the 1958 Annual Meeting of the Society of Plastics Engineers, Detroit, Mich.
[1]Numbers in parentheses link to references at end of article, p. 214.

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Table I: Calculation of Larson-Miller parameters

(a) Above knee of curve

At 1600 p.s.i. hoop stress (Fig. 1)

At 122° F. (50° C.) $t = 0.027$ hr., $\log t = -1.570$

At 50° F. (10° C.) $t = 85{,}000$ hr., $\log t = 4.9300$

$323\ (C - 1.570) = 283\ (C + 4.930)$

$C = 47.5$

Values of parameter at:

Stress	*50° F.*	*59° F.*	*68° F.*	*122° F.*	*176° F.*
p.s.i.					
2,500	13,700	13,600	13,500	—	—
2,000	14,260	14,150	14,050	—	—
1,600	14,830	14,720	14,650	14,800	—
1,200	15,250	15,130	15,400	15,600	16,050
1,000	15,400	15,460	15,580	16,100	16,600
800	—	15,600	15,700	16,400	17,140
600	—	—	15,910	16,580	17,380
400	—	—	—	16,800	17,580

(b) Below knee of curve

At 500 p.s.i. hoop stress (Fig. 1)

At 122° F. (50° C.) $t = 13{,}800$ hr., $\log t = 4.141$

At 176° F. (80° C.) $t = 100$ hr., $\log t = 2.00$

$323\ (C + 4.14) = 353\ (C + 2.00)$

$C = 21.0$

Values of parameter at:

Stress	*50° F.*	*68° F.*	*122° F.*	*176° F.*
p.s.i.				
2,500	6,200	5,720	—	—
2,000	6,770	6,290	—	—
1,600	7,330	6,900	6,280	—
1,200	7,770	7,620	7,110	6,710
1,000	8,000	7,800	7,570	7,290
800	—	7,920	7,850	7,800
600	—	8,150	8,020	8,030
400	—	—	8,250	8,250

Table II: Time to stress-crack F_{50} for Hi-fax high-density polyethylene in ½% solutions of Igepal and water at various temperatures

	Time to stress-crack F_{50}	
	40-mil thick specimen[a]	*125-mil thick specimen*
In ½% Igepal solution:	*hr.*	*hr.*
Temperature 50° C.		
Hi-fax M.I.[b] = 0.3	216	96
Hi-fax M.I. = 0.07	2700	216
Temperature 90° C.		
Hi-fax M.I. = 0.3	—	ca. 16
Hi-fax M.I. = 0.07	—	24
In distilled water:		
Temperature 90° C.		
Hi-fax M.I. = 0.3	88	4
Hi-fax M.I. = 0.07	500	32

[a]Since the maximum fiber stress in the 40-mil specimen at 50° C. is the same as that in a 125-mil specimen at 90° C., this permits use of Underwood's suggestion for the calculation of the value of C:

For M.I. = 0.3: ($M_w = 200{,}000$)

$323\ (C + \log 216) = 363\ (C + \log 16)$

$C = 7.5$

For M.I. = 0.07: ($M_w = 350{,}000$)

$323\ (C + \log 2700) = 363\ (C + \log 24)$

$C = 16$

[b]M.I. = melt index

be expressed by the following relationship:

$$\text{Parameter} = T\ (C + \log t)$$

where T is absolute temperature, C is a constant, and t is the failure time in hours at the temperature and stress given. The parameter is derived from the relationship that the rate of any chemical process is proportional to a constant times the factor $e^{-Q/RT}$ where Q is the energy of activation of the process. By simplifying assumptions[2] one can show that the value of C is approximately proportional to the value of Q and hence that it relates to the activation energy of the process, the process in this case being pipe failure brought about by slitting or cracking.

From experimental data at 50 and 80° C. given in Fig. 1, using stresses below the knee of the curves in that figure, the value of C for high-density polyethylene pipe can be estimated using the procedure suggested by Underwood. From this calculation (Table I, left) C was found to have a value of about 21. Using the failure time shown at 10 and 50° C. for such pipe, at stresses giving failures within observed times above the knee of the curves, similar calculations gave a value of C of 47.5. Using these constants, Larson-Miller curves were constructed for pipe made from Hi-fax.[3] These curves are shown in Fig. 2, p. 148.

When C in the correlation was 21, the curves given for different temperatures diverged greatly above the knee of the curve, but they all coincided below it. When C had a value of 47.5, the curves fully coincided above the knee of the curve but diverged considerably below the knee. The different values of C reflect the fact that a process involving ductile failure operates above the knee, whereas one involving brittle failure operates below it.

We believe it is very significant to point out that over the range

[2]Carey and Oskin (6) show that the Larson-Miller parameter bears a relationship to the form of the general rate process equation thus:
Larson-Miller: $T\ (C + \log t) =$ parameter
Rate process: $T\ (\log A + \log t) = Q/2.3R$
In the correlations shown, C, with a value of 21 to 47, is much greater than $\log t$ which has values of −2 to 7. On this basis, the statement that C is approximately proportional to the energy of the rate process is justified.

[3]Hercules Powder Co.'s registered trademark for high-density polyethylene.

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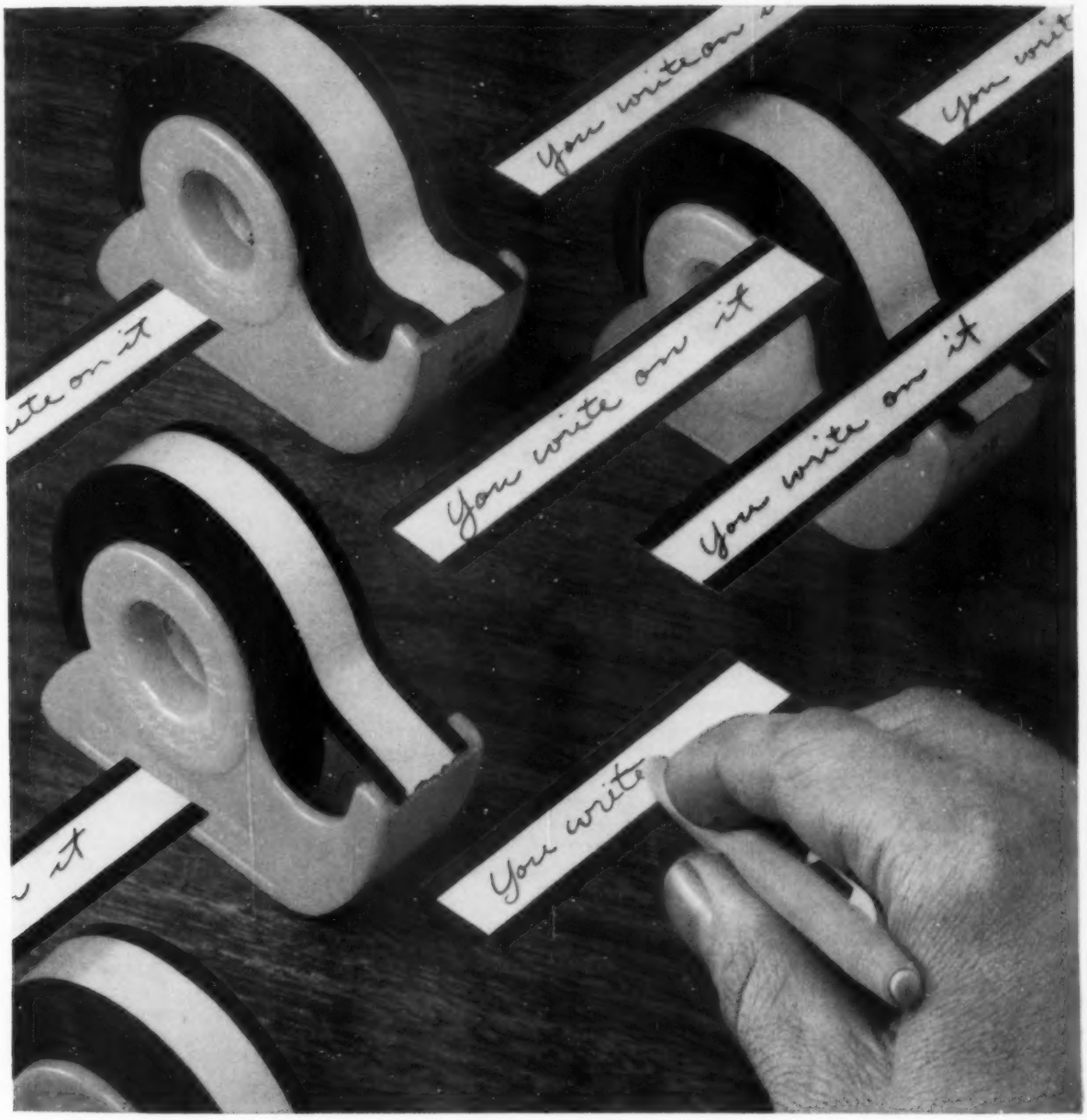

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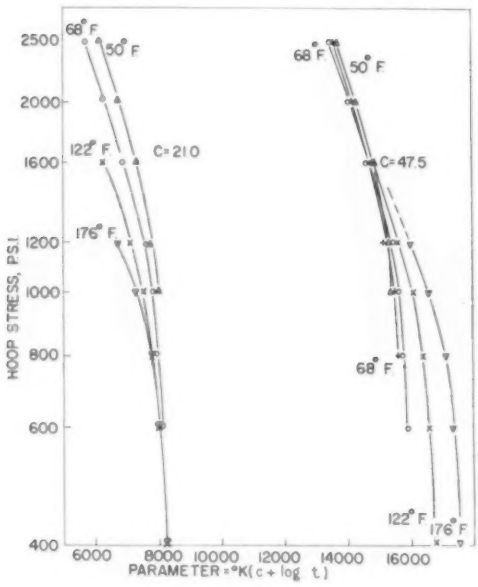

Fig. 2: Larson-Miller correlation of data on failure time

of observed and predicted times from one to more than 500,000 hr. shown in Fig. 1, for all locations of the stress-time to fail curve shown below the knee at the various temperatures of test, the values of the Larson-Miller curves calculated using a value of C equal to 21 all coincide. This seems important because it indicates that the extrapolation made by a different method in Europe has been checked by a method of extrapolation that is well understood in the United States when applied to hot metals and plastics loaded under conditions that should cause creep. It is another piece of evidence that the predicted life of pipe made from this high-density polyethylene will in fact conform to that shown in Fig. 1. The second point worth mentioning is that the coincidence of the curves calculated using C equal to 47.5 from the data given above the knee, all of which failures are of the ductile type, indicate that in this case a different process of failure is operating than in the case of the failures shown below the knee of the curves. The values of C, in turn related to the value of Q, indicate that the energies involved in brittle failure are approximately half of those involved in ductile failure.

Application to stress-cracking data

We have also tried to apply this analysis to the results of stress-cracking tests carried out by the well-known Bell Laboratories method as set forth by DeCoste, Malm, and Walder (7). In Table II, p. 146, are given F_{50} times for half the specimens to stress-crack at two different temperatures, 50 and 90° C., when exposed to a 0.5% solution of Igepal, a nonionic surfactant, in water. For material of melt index 0.07, of the same molecular weight as that used in the pipe testing shown in Fig. 1, it is found that the value of C obtained applying the method developed by Underwood is of the order of 16.

Following the considerations of activation energy shown above, it seems evident that the failure process we are dealing with in these stress-cracking tests is of the same order of energy as that which governs the brittle failure of pipes below the knee of the long-term pressure testing curves given in Fig. 1. It can also be noted that C decreases as the molecular weight of the high-density polyethylene decreases. This is also similar to the behavior that was noted observed in pipe tests.

Perhaps the difference in absolute value between these values of C and those found for the pipe failures can be accounted for by the fact that the level of stress in the stress-cracking tests, at the temperatures used, is considerably higher than that observed in the pipe tests.

Application of results to design of pipe

All the facts given above on pipe are based on data furnished to us from Europe, where the

(*To page* 214)

Table III: Pipe wall thicknesses (t) made of Hi-fax high-density polyethylene to match pressure ratings of CS197-57 pipe made of low-density polyethylene

Nominal size	d_i	*Series 1*[a]		*Series 2*[b]		*Series 3*[c]	
		t	d_o	t	d_o	t	d_o
in.	in.	in.	in.	in.	in.	in.	in.
½	0.622	0.047	0.716	0.041	0.704	0.055	0.732
¾	0.824	0.058	0.940	0.054	0.932	0.073	0.970
1	1.049	0.069	1.187	0.069	1.187	0.093	1.235
1¼	1.380	0.085	1.550	0.090	1.560	0.122	1.624
1½	1.610	0.085	1.780	0.105	1.820	0.142	1.894
2	2.067	0.085	2.237	0.135	2.337	0.182	2.431

[a]Series 1: range from 90 to 50 p.s.i. pressure rating at 73.4° F.
[b]Series 2: 75 p.s.i. pressure rating at 73.4° F.
[c]Series 3: 100 p.s.i. presure rating at 73.4° F.

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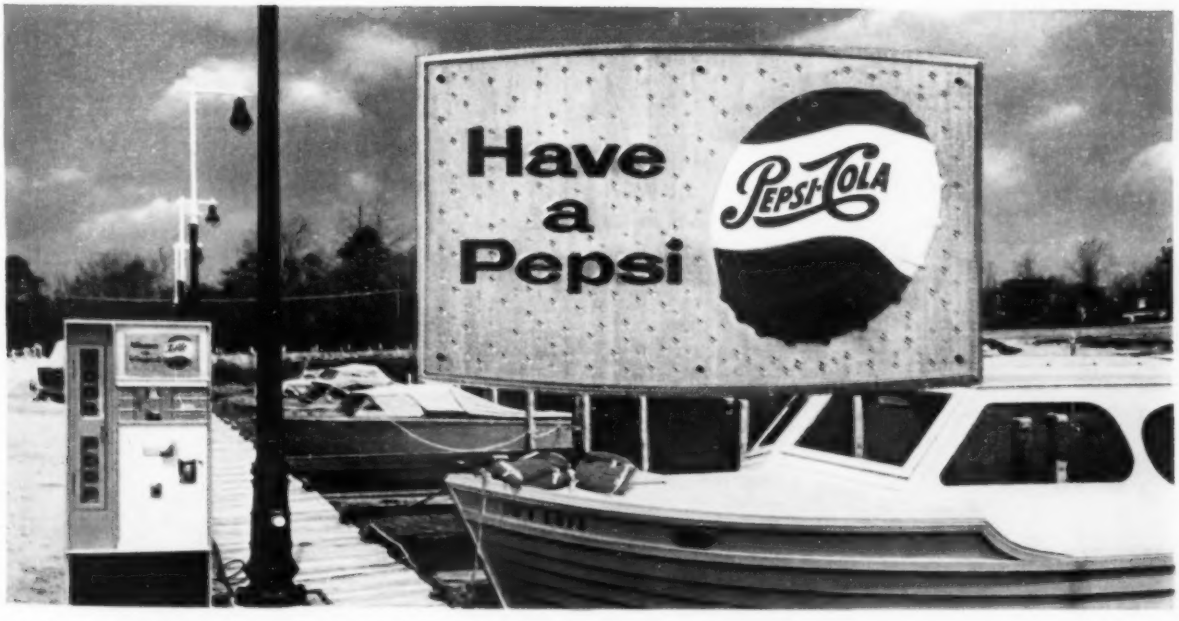

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General

Resin sales reflect the silicone surge. Chem. Week *83*, 85-86, 88 (July 1958). The sales and production figures on silicone rubbers, resins, and oils are discussed. The demand for silicones has increased from 7 million lbs. in 1951 to an estimated 15 million lbs. in 1958.

Plastics make headway in Japan. Chem. Eng. News *36*, 68-9 (June 23, 1958). The production of plastics in 1958 in Japan will be about 40% above 1957, about 340,000 tons. Production and consumption data on types of plastics are reported.

Polymer research moves fast. Chem. Eng. News *36*, 100-01 (July 21, 1958). Current trends in polymer research in Germany, Russia, France, and the United States are summarized. New polymers and new methods of synthesizing polymers are stressed.

Materials

Compounding polyurethanes. R. J. Ferrari, J. W. Sinner, J. C. Bill, and W. F. Brucksch. Ind. Eng. Chem. *50*, 1041-44 (July 1958). The compounding of polyurethane foams to yield useful physical properties and improved resistance to humid-aging exposure is described. Three reactive intermediates are examined: adipic acid polyester, dimer acid polyester, and a polyoxyalkylene glycol. All were foamed with toluene diisocyanate, with adjustments in formulation, process, and curing to produce foams of satisfactory low density and reasonable compression set. The range of compression modulus, an index of stiffness, appears to be characteristic of the choice of reactive intermediate. In stability to humid aging, dimer acid polyester and polypropylene glycol, the two intermediates of lower water absorption index, gave the most durable foams.

Physical properties of monomeric acrolein and some polyacroleins. R. C. Schulz. Kunststoffe *48*, 257-61 (June 1958). Some of the physical properties of certain polyacroleins are described and compared with those of other vinyl polymers. Investigation of molecular refraction and infrared spectra gives an indication concerning the main structural elements which agrees with the formula derived from chemical reactions.

Molding and fabricating

How to machine laminated plastics. T. R. Silk. Iron Age *181*, 77-80 (May 1); 106-09 (May 8); 82-85 (May 15, 1958). Specific details are given for machining operations on laminated plastics. Shearing, sawing, cut-off, turning, drilling, tapping and threading, milling, gear cutting, planing and shaping, punching, shaving, broaching, postforming, finishing, and marking are discussed.

Production of porous leathercloth. H. G. Schwabe. Kunststoffe *48*, 285-87 (June 1958). The various known processes for making "breathable," i.e., porous PVC sheeting by mechanical means without affecting the moisture vapor permeability are described; these include the use of additives, electrical methods or partially coating the supporting fabric. A new method, referred to as the "Dornair Method" has opened up new fields in the textile coating industry, leading to interesting side developments in the coating of metal foil, wood, cardboard, and glass fiber supports.

Pneumatic feed devices for granulates. W. Paul. Kunststoffe *48*, 283-84 (June 1958). Pneumatic feed devices were developed for the filling of the feed hopper of injection molding machines and screw extruders with powdered or granulated materials. These save manual labor, and in the case of big machines where manual operations are frequently too awkward to be economical, they help in the smooth running of the molding shop. They also ensure the supply of a constant quantity of molding compound which governs the continuous and constant feed of material to the mold. The various types of equipment on the market today throughout the world are described.

Chemical frosting of methacrylate plastics. R. H. Bicker and R. G. Winter. Rev. Sci. Instr. *28*, 843 (1957). Different periods of immersion in concentrated nitric acid of methacrylate plastics provided a surface appearance similar to that of ground glass or translucence comparable to that of white paper.

Injection molding and extrusion of Moplen. A. Bosoni. Plastics Tech. *3*, 556-59 (June 1958). Problems involved in injection molding and extrusion of polypropylene are discussed. Particular attention is given to remedies for difficulties that may be encountered.

Applications

Plastics to boom in building. Chem. Eng. News *36*, 26-27 (June 16, 1958). The use of plastics foams is expected to increase 500% in building in the next few years.

Erratic performance of Type 1 unplasticized polyvinyl chloride in 93% sulfuric acid pipelines. H. E. Atkinson, Jr. and R. F. Degnan. Corrosion *14*, 261-62 (June 1958). There are differences in the resistance of various vendors' Type 1 polyvinyl chlor-

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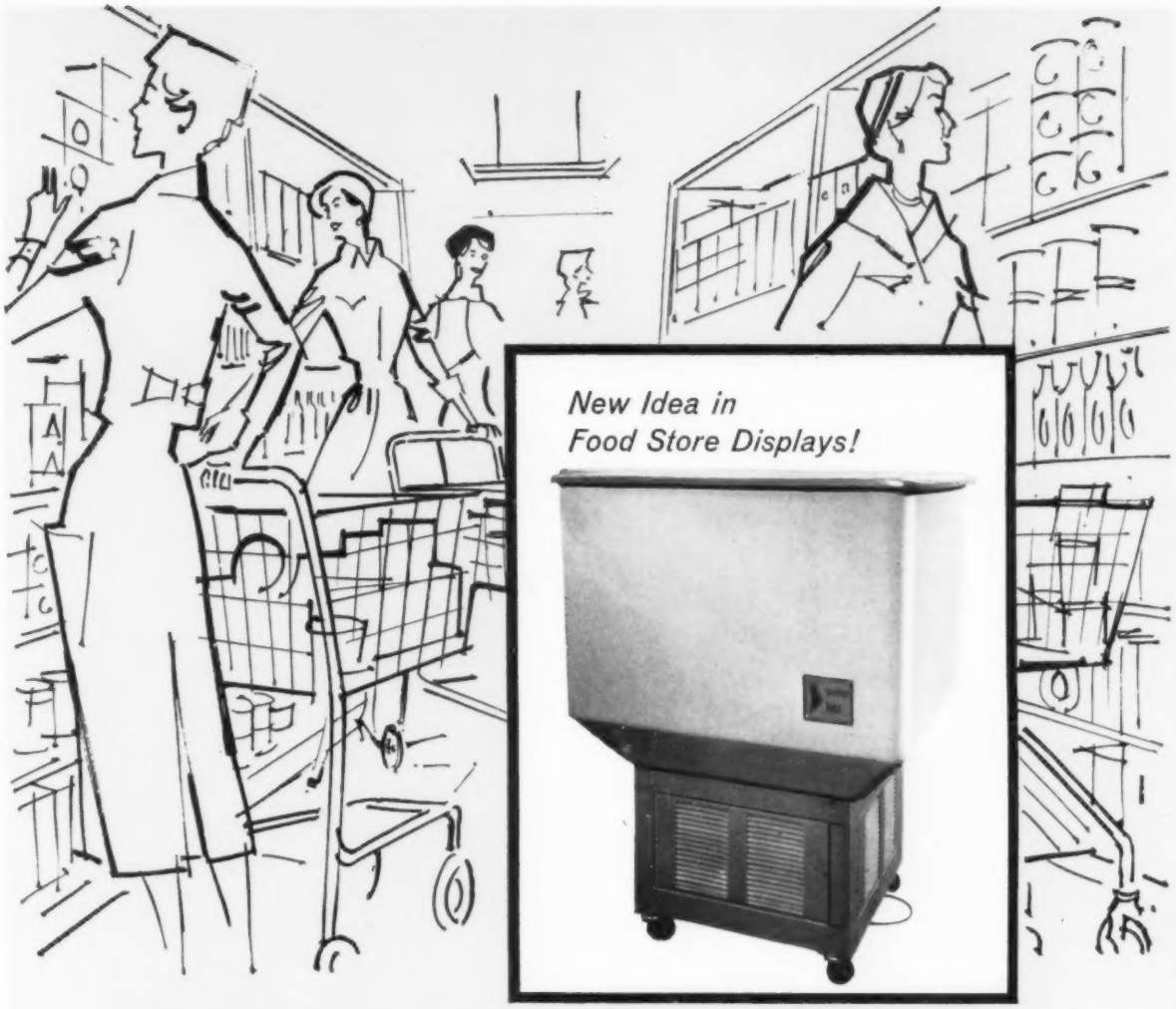

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ide to extremely corrosive sulfuric acid. A test program was set up to evaluate the resistance of six samples. Tables are presented giving the results of these tests.

Conductive adhesive for electronic applications. T. J. Kilduff and A. A. Benderly. Elec. Manuf. *61*, 148-52 (June 1958). The preparation and properties of a low viscosity, high bond strength conductive adhesive is described. The basic formulation consisted of an epoxy resin mixed with butyl glycidyl ether, which acted as a reactive diluent and metallic silver to provide the electrical conductivity. The details of preparation are given. The conductive silver-epoxy adhesive has been used in applications such as ferrite microwave detectors, high frequency vibrators, selenium rectifiers, and repairs to printed circuits.

Epoxide resins versus corrosion. L. M. Barakan and G. L. E. Wild. Corrosion Tech. 5, 137-40 (May 1958). Four types of epoxy systems are currently in use as industrial finishes, particularly in the field of corrosion protection of metals. Each type is discussed and its properties, advantages, and disadvantages compared with the more common finishes. Included are ester type epoxies which air dry by oxygen absorption; cold-setting, two-component systems which cure by chemical reaction at room temperature; and two heat-setting types requiring temperature ranges of 250 to 300° F., and 350 to 400° F. for cure.

Applications for polyvinyl alcohol in the paper industry. D. F. Lowry. Paper Trade J. *141*, 26, 28 (Dec. 23, 1957). Numerous uses for polyvinyl alcohol in the paper industry are described. The proper choice of degree of hydrolysis and viscosity of polyvinyl alcohol for specific applications is described and processing hints are given.

Properties

Early detection of weathering damage in polyethylene. J. W. Tamblyn, G. C. Newland, and M. T. Watson. Plastics Tech. *4*, 427-32, 455 (May 1958). Three methods of detecting early weathering damage in polyethylene are discussed: formation of ketonic carbonyl groups; development of cracks in stressed specimens; and loss of tensile elongation. In unprotected polyethylenes, carbonyl formation during outdoor weathering does not correlate well with stress-cracking resistance or loss of elongation. Caution is indicated in using carbonyl formation as the only measure of weathering breakdown. Unprotected polyethylene in thick sections retains sufficient toughness and tensile properties after two years' outdoor exposure to be suitable for some outdoor applications. For polyethylene containing additives, carbonyl formation correlated well with the other two measures of breakdown only with the best stabilizer (5-benzylidene-3-hexadecyl-2-phenylimino- 4-thiazolidone). This stabilizer showed excellent ability to retard all three types of weathering damage. A composition containing 1% of this thiazolidone had good tensile properties after three summers' outdoor exposure. Several other stabilizers retard all three types of weathering damage for exposure times greater than 14 months outdoors, but underwent stress-cracking and severe loss of tensile properties after longer exposure times.

Effects of molding pressure on properties of glass-fiber reinforced plastics. S. D. Toner, I. Wolock and F. W. Reinhart. SPE J. *14*, 40-45 (June 1958). The effects of variations in molding pressure on the physical properties of glass-fabric and glass-mat reinforced polyester laminates were investigated. Laminates were molded in both open and closed molds at pressures up to 500 p.s.i. Standard methods of tests were used to evaluate the changes in tensile and flexural strength and moduli of elasticity, compressive strength, specific gravity, and resin content. The results indicate little or no effect of pressure on laminates fabricated in closed molds where resin content was maintained constant. Significant changes in properties were noted for laminates fabricated in the open molds where resin content was a function of pressure.

Heat and ultra-violet aging of polyvinyl chloride. C. F. Bersch, M. R. Harvey, and B. G. Achhammer. J. Research Nat. Bur. Stds. *60*, 481-88 (May 1958). Four polyvinyl chloride polymers prepared with different initiators were exposed to ultra-violet radiant energy and to heat, in a vacuum and in air. The gaseous products evolved were analyzed by mass spectrometry. Changes in chemical structure were followed by infra-red spectrophotometry. Benzene was among the products evolved in most cases, and acetone was produced during exposure to heat in air. Catalyst fragments or other incorporated impurities affected initiation at very mild conditions. Susceptibility to degradation increased with increasing oxygen content and unsaturation of the untreated polymer. Pyrolysis studies indicated a two-stage degradation: 1) dehydrochlorination, and 2) decomposition of the resultant polyene chain. Color formation was attributed to both oxidation and conjugated unsaturation because exposure in air following exposure in a vacuum, and vice versa, caused bleaching of the degraded polymer.

Tensile properties of some plastics at low temperatures. J. Dyment and H. Ziebland. J. Appl. Chem. *8*, 203-06 (Apr. 1958). Four polymeric materials were evaluated for tensile properties at +20°, −75°, −120°, and −196° C. Polytetrafluoroethylene was studied because of interest in its use in air-liquefaction equipment. Three other polymers, polycaprolactam, rigid polyvinyl chloride, and polytrichlorofluoroethylene, were included because no low temperature data for these materials were available. Data were obtained on ultimate tensile strength and the percent permanent extension. Young's modulus was calculated from the stress-strain curves. In all cases, strength and modulus values increased with decreasing temperature. Values for polytetrafluoroethylene ranged to 10 times the strength at room tem-

perature, and this material showed some ductility even at −196° C. Values for the other three materials increased to about three times those obtained at room temperature. Brittle fractures were obtained only at the two lowest temperatures with polycaprolactam and polyvinyl chloride.

Testing

The radiography of polythene. D. C. Shotton. Brit. Plastics *31*, 249-52, 262 (June 1958). A new technique is described for nondestructive testing of polyethylene (PE) moldings by use of X-radiation. The principles of the method, the instrumentation, and interpretation of results are presented. Soft X-rays are used to test for voids, cracks, metal and organic particles which might cause premature failure in PE cable sheathing. Some of the results obtained with moldings and joints on underseas telephone cable parts are described.

Heat problems raised by higher speeds of planes. Physical and mechanical testing methods for light weight materials. B. Persoz. Rev. Gen. Caout. 35, 41-7 (Jan. 1958). The temperature of a surface passing through the atmosphere is a parabolic function of the speed. Polymeric materials limit the heat flux to the inside of the plane while contributing to stiffness and vibration damping. Several static and dynamic test methods are described to study the thermal and mechanical properties of materials for application in planes.

Small tunnel-furnace test for measuring surface flammability. H. D. Bruce and V. P. Miniutti. ASTM Bulletin No. *230*, 61-68 (May 1958). A small tunnel-furnace apparatus for determining flammability of materials is described. Results of tests on wood, building boards, plywood, glass fiber, and glass-fiber-reinforced plastic are reported.

Chemistry

2,4,6-Triphenylphenoxyl, an effective polymerization inhibitor. J. W. Breitenbach, O. F. Olaj, and A. Schindler. Monatsh. Chem. *88*, 1115-16 (1958). The polymerization of styrene and acrylonitrile is effectively inhibited by 2,4,6-triphenylphenoxyl, a comparatively stable oxygen radical which exists in equilibrium with its dimer.

Soluble catalyst helps properties. Chem. Eng. News *36*, 56 (July 21, 1958). A catalyst that is soluble in the solvent medium, usually toluene or n-heptane, for the polymerization of ethylene is described. It is the reaction product of bis(cyclopentadienyl) titanium dichloride and diethylaluminum chloride. A new type of polyethylene is produced.

Polymerization of olefins by complex metal catalysts. J. K. Stille. Chem. Rev. *58*, 541-80 (June 1958). The literature on the polymerization of olefins by complex metal catalysts is reviewed. 205 references.

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Review of Scientific Instruments: American Institute of Physics, 57 East 55th St., New York 22, N. Y.

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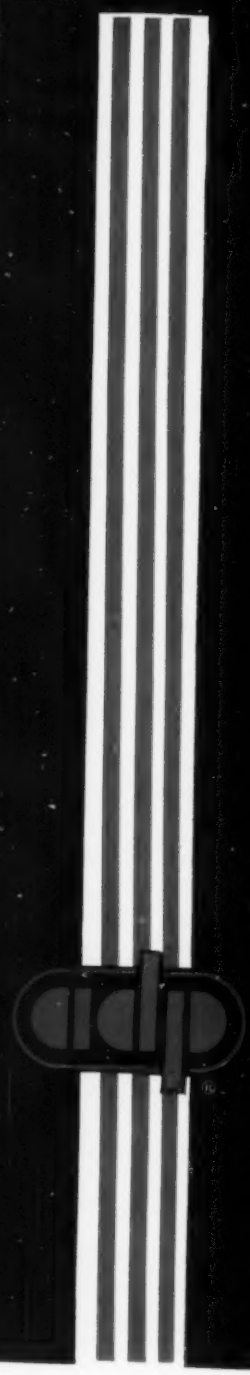

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The Boeing Airplane Company needed a special material for window shades of the luxurious Boeing 707. To meet this need, Seiberling custom-designed a new type of SEILON with these unique specifications:

- rolls up on a very small core
- reflects all infra-red rays
- offers uniform .008" thickness
- is completely opaque to light
- resists growth or change in size
- is easily cleaned
- is fireproof

Aloft with the "707" since her initial test flights, the new SEILON once again proves Seiberling's "custom" development abilities. SEILON represents a family of rigid thermoplastic sheet materials; available in calendered rolls and sheets, press-laminated sheets or extruded sheets.

Because one type of SEILON may possess the exact properties you require, we would welcome the opportunity to consult with you. Please write or phone us at your earliest convenience.

Plastics Division

SEIBERLING
RUBBER COMPANY

NEWCOMERSTOWN, OHIO Phone 8-8304

of a glycol, an alkylene diamine dicarboxylate and a sulfone ester.

Copolymerization. H. K. Garner (to U. S. Rubber). U. S. 2,839,509, June 17. Vinyl chloride-dialkyl maleate copolymers.

Polymers. R. E. Benson (to Du Pont). U. S. 2,839,510, June 17. Polymer of trimethylene cyclohexane.

Copolymers. J. O. Harris and M. H. Wilt (to Monsanto). U. S. 2,839,511, June 17. Cyanoether ester copolymers.

Copolymers. E. R. Barnum, L. E. Lorensen and J. Zachar (to Shell). U. S. 2,839,512, June 17. Vinylidene long chain acrylic ester copolymers.

Polymers. A. H. Ahlbrecht, W. S. Friedlander and W. A. Severson (to Minnesota Mining). U. S. 2,839,513, June 17. Polyfluoroacrylic esters.

Copolymer. E. C. Shokal, P. A. Devlin, and D. E. Winkler (to Shell). U. S. 2,839,514, June 17. Copolymer of allylglycidyl ether and styrene.

Copolymers. J. M. Davison and J. F. Erdmann (to Carbide and Carbon). U. S. 2,839,515, June 17. Copolymers of ethylene and alpha-unsaturated olefins.

Resin. L. S. Cohen and J. R. Zietz, Jr. (to Ethyl). U. S. 2,839,517, June 17. Polypropenylbenzene.

Polyethylene. D. L. Brebner (to Du Pont). U. S. 2,839,518, June 17. Polyethylene of controlled molecular weight.

Polyethylene. L. Seed (to Imperial Chemical). U. S. 2,839,519, June 17. Ethylene polymerization.

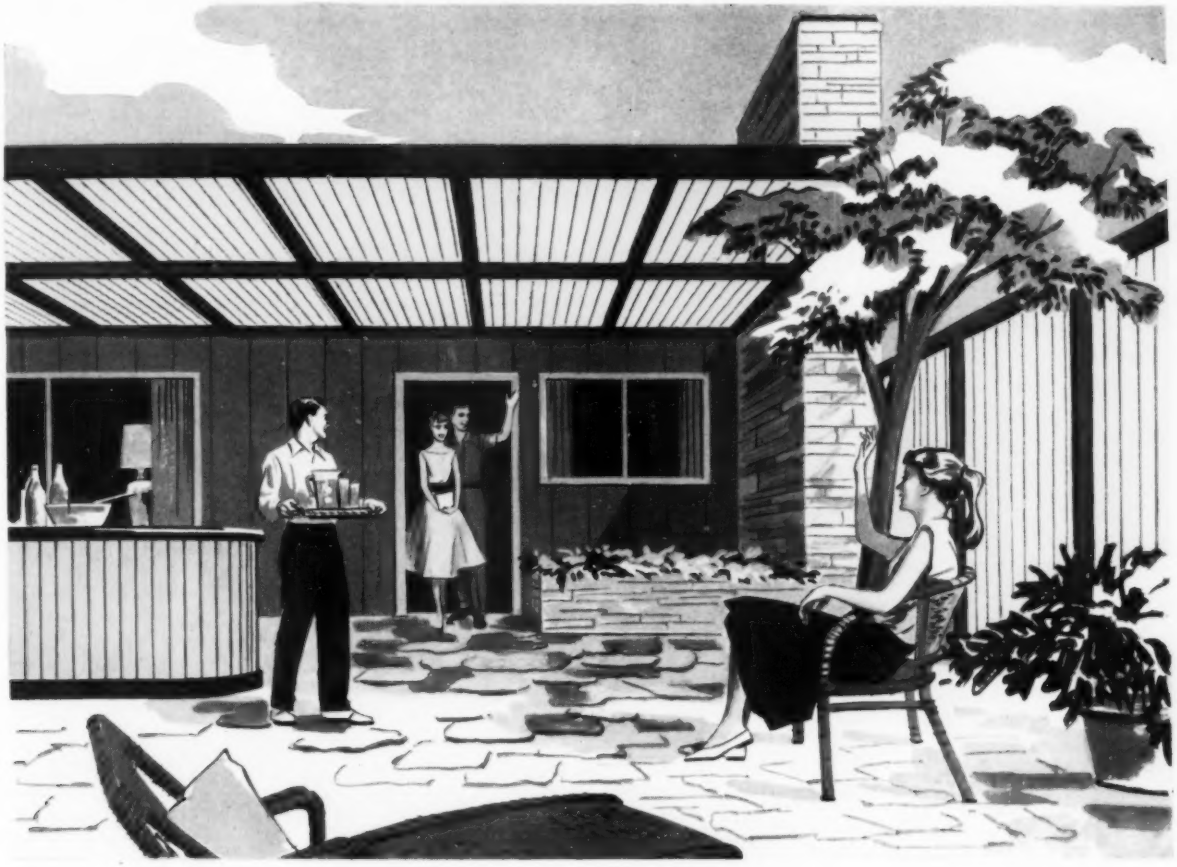
Ion exchange. J. C. H. Hwa (to Rohm & Haas). U. S. 2,840,533, June 24. Anion exchange resins.

Foam resins. L. Clark and A. C. Poshkus (to Armstrong Cork). U. S. 2,840,534, June 24. Using ammonium alum to stabilize foamed vinyl resins.

Resin. H. D. Crandon and T. E. Burgess (to American Optical). U. S. 2,840,535, June 24. Plasticized alkyd resin.

Resins. J. Kleine, E. Siggel and R. Gerlach (to Glanzstoff-Fabriken). U. S. 2,840,537, June 24. Polycondensing diol esters of terephthalic acid.

Resins. H. F. Minter and J. Swiss (to Westinghouse). U. S. 2,840,538, June 24. Polyester molding compositions.



Specially formulated for corrugated reinforced plastic sheeting...

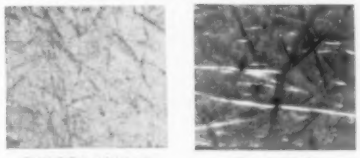
GLIDPOL 1001-LS polyester resin system offers greater resistance to sunlight, weathering!

GLIDPOL 1001-LS is recommended for manufacturing reinforced plastic sheeting for skylights, awnings, windows, fences, windbreaks and other products exposed to direct sunlight and weather. This light-stabilized, medium viscosity resin has excellent initial gloss and color; offers maximum resistance to fading and discoloration (see proof at right).

When diluted with Styrene or Methyl Methacrylate, GLIDPOL 1001-LS possesses all of the desirable liquid resin, gelation and curing properties. It permits rapid wetting of glass fibers, and responds to regular peroxide and hydroperoxide catalysts. Where direct sunlight is encountered, dilution with Methyl Methacrylate will improve the resistance to weathering and extend the service life of any product by reducing the surface erosion and fiber blooming.

Ready-to-use GLIDPOL 1001-LS resins, pre-pigmented with light-fast colors, can be custom-formulated to meet your requirements. Write for details.

AFTER 24 MONTHS EXPOSURE



GLIDPOL 1001-LS | Resin "A"

Photograph (reduced to one-half actual size) taken after 24 months exposure to Florida sun shows little change in reinforced panel containing GLIDPOL 1001-LS diluted with Methyl Methacrylate. Marked discoloration, surface erosion and fiber blooming resulted when panel made with Resin "A"— diluted with Styrene only—was exposed same length of time.

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GLIDPOL POLYESTER RESINS

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900 Union Commerce Bldg., Cleveland 14, Ohio

San Francisco • Los Angeles • Chicago (Nubian Division—1855 North Leclaire Avenue) • Minneapolis • St. Louis • New Orleans
Cleveland • Atlanta • Reading • Canada: Toronto and Montreal

New Machinery and Equipment*

Surface cleaner

Plastics surfaces that must remain clean can be treated with GTC-59, a spray-on compound that cleans and degreases, deposits a smooth, water-repellent coating, cancels static electricity, and keeps surface free of dust and dirt build-up for long periods. (Required cleaner for electron-optical systems of U. S. Air Force.) *Beaver Laboratories, Inc., 187-61 Hollis Ave., Hollis 23, N. Y*

Improved 4-oz. molder

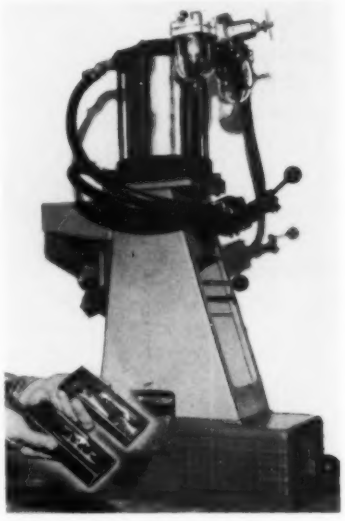
The Moslo Model 75 high-speed automatic injection machine has been redesigned to increase its economy, safety, and convenience. Standard equipment now includes plug-in type instruments (timers, heat controllers, and limit switches), 110-v. control circuits, unloading valve in hydraulic system. Clamping mechanism has simple, cushioning feature that slows ram at end of stroke, features Nitraloy bushings around toggle pins to retard wear, reduce maintenance. New feed hopper, of 75 lb. capacity, has shutoff and is designed to prevent erratic feeding of granules to cylinder. *Moslo Machinery Co., 2443 Prospect Ave., Cleveland 15, Ohio.*

Circular saw blades

Plasti-Kerf saw blades are claimed to be the "first type of carbide tipped blade where the teeth can be honed to razor sharpness." Specific tooth arrangements can be custom-made to solve special problems. The teeth are of extremely narrow gage, keeping kerf to minimum consistent with rim rigidity and smooth cutting. Will not chip or burr edges of extruded shapes. *Forrest Mfg. Co., Inc., 243 Highway 17, Rutherford, N. J.*

Bench-model molders

Two new models in the Mini-Jector line, the Wasp 35 and 45, are both bench-model injection molding machines designed to be used with simple V-block molds. The machines are intended primarily for development work and short production runs of small parts. Shot capacity is 1 oz., top molding pressure is 30,000 p.s.i., maximum mold area is 6 sq. inches. With small pieces, multiple cavities are practical. Interchangeable cavity cells are available. These small molders operate on available air or hydraulic power, can be equipped with lever, push-button, or automatic controls. Price: "under $1000 for machine and mold blank." *Newbury Industries, Inc., Newbury, Ohio.*



Newbury bench Model 45 Mini-Jector cuts tooling costs with V-block molds

Moslo Model 75 4-oz. molding machine has been redesigned to increase its economy, safety, and convenience

TFE-resin wire coater

The Model TE-1A extruder is designed especially to cover wire with Teflon TFE-resin paste, then dry and sinter this to a solid coating. Said to produce finished wire at speeds three times that of previous machines, the new machine also yields better quality and gives greater production flexibility. Triple-pass vaporizing and

*Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents. Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

Brighton Plastics re-ordered

VAN DORN presses again and again

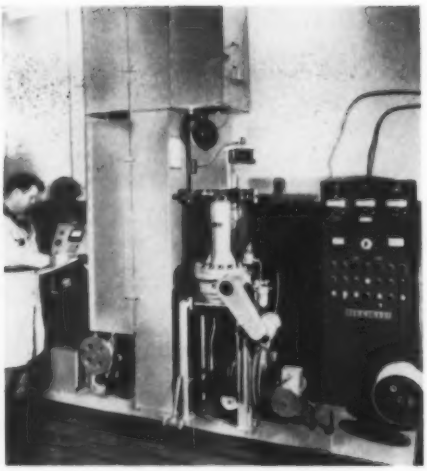
Several years ago Brighton Plastics of Rochester installed a Van Dorn H-250 to produce nylon gears for electric clocks. They inject gears in a multiple cavity mold at a production rate of 5 shots per minute. The Van Dorn press performed so well that Brighton ordered another, and later still, a third.

Van Dorn presses mold nylon better because they insure:

1. Better material control
2. Easier maintenance of close tolerances
3. Lower mold investment
4. Less waste in purging
5. Automatic cycling

The outstanding features of Van Dorn presses for molding all thermoplastics are fully described in literature available upon request.

THE Van Dorn IRON WORKS CO.
2685 EAST 79th STREET • CLEVELAND 4, OHIO



Jennings Model TE-1A extruder is designed to cover wire with Teflon TFE-resin paste, then dry and sinter to solid coating

sintering ovens increase residence time without increasing oven size, thus making possible the higher speeds. Several interchangeable extrusion cylinders are available, and they can be exchanged in 20 minutes. Capstan speed is adjustable from 0 to 105 ft./minute. Only special facilities needed are standard plant air and 6-in. exhaust pipe. Overall dimensions are 3 ft. wide, 9 ft. long, and 14 ft. high. *Jennings Machine Corp., 3452 Ludlow St., Philadelphia 4, Pa.*

Film perforator

The Stewo machine perforates films with holes up to ¾ in. in diameter, can operate with plastics films, foils, rubber sheeting, etc. Four models are designed to process webs having maximum widths of 31.5, 39.2, 49.2, and 68.8 in., at rates up to 2600 ft./hour. A fifth, smaller unit (Model RP) is designed to handle cut sheets, bags, etc. Made in Germany by Heinz Steffens, Steponath, & Wolters OHG, Hilden, Rhineland, these perforators are sold and serviced in the U. S. by *J. Poser & Co., 251 W. 30th St., New York 1, N. Y.*

Portable pyrometers

The Model B line of portable pyrometers is available with sensing elements for measuring temperatures of convex, rotating, or flat surfaces, of melts, thin liquids, and gases. Scales are almost 4 in. long, are available in six ranges from 0-to-400° F. to 0-to-1600° F., and similar ranges in Centigrade. Prices vary some, but are about $55 to $65 without lead-in or element. Smallest scale division is about 1% of range on all ranges. These new models have built-in compensation for changes in room temperature. Lead-ins are either rigid-arm type or flexible-handle type, and are interchangeable without upsetting calibration, as are the various sensing elements. *West Instrument Corp., 4363 W. Montrose Ave., Chicago 41, Ill.*

Automatic closure molder

The Model 742 automatic closure-molding press supersedes the earlier Model 252, but can use any molds made for the older press. The 742 can mold caps of any size, shape, or form, with internal or external threads, in molds with as many as 90 cavities. Total dry-cycle time with an 8-in. stroke is 13 sec. not counting curing time. For molding caps 20 mm. and larger, the standard press with its own powder feeder is satisfactory. For smaller caps a ball-preform feeder is needed; this is an optional extra. By removing the unscrewing device, the press is easily converted to a conventional automatic compression press, and it will accommodate all existing molds for the Model 741 without modification. Maximum stroke is 10 in., daylight 26 in., mold area 18 by 13 inches. Other features are identical to those of the 741. *F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.*

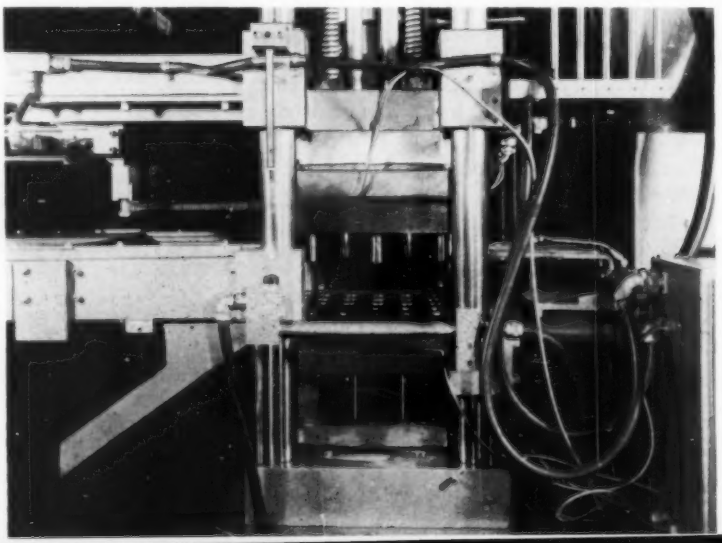
Oven with dehumidifier

The Model PLHD-2-5 is a drawer-type drying oven for preheating and drying molding powders at temperatures ranging from 150 to 450° F. The built-in, desiccant-type dehumidifier keeps the moisture content at less than 0.3% and will dry nylon down to 0.15% moisture at 175° F. The 7.5-kw. Nichrome heating elements are turned on or off by an indicating controller. The warmed air is circulated through the trays in the 10 drawers by a ¾-hp., 1100-c.f.m fan. Drawers are 20 in. wide, 30 in. long, 3.5 in. deep. Price: $1870. *Despatch Oven Co., 619 S. E. 8th St., Minneapolis 14, Minn.*

Sheet thermoformers

The Model AC-3648 automatic forming machine is a self-contained unit that needs only to be connected to electricity and compressed air supplies to run. Two different heaters are available, depending on operating temperature desired. Both are zoned for convenient and economical use with molds of various sizes, can be adjusted both in height and tilt. Clamping frame is adjustable, automatically air-actuated, takes sheets up to 3 by 4 ft. (mold area). Straight vacuum forming and drape forming are possible on standard machine, with plug-

Stokes Model 742 automatic closure molding press is fitted with a rack-type unscrewing device, shown at left center, which is attached to the moving platen



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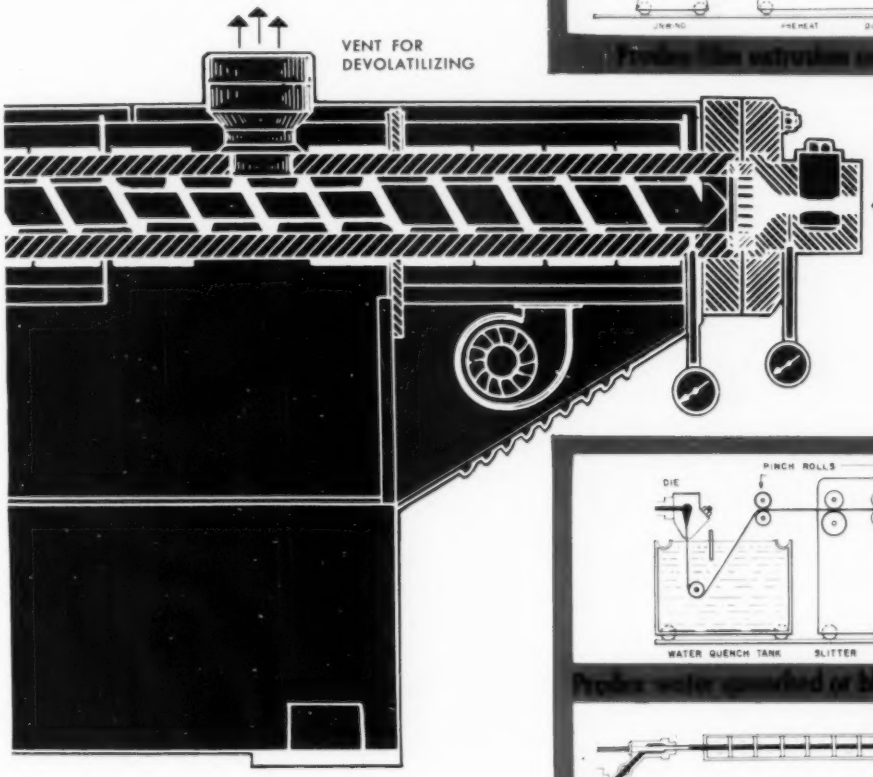

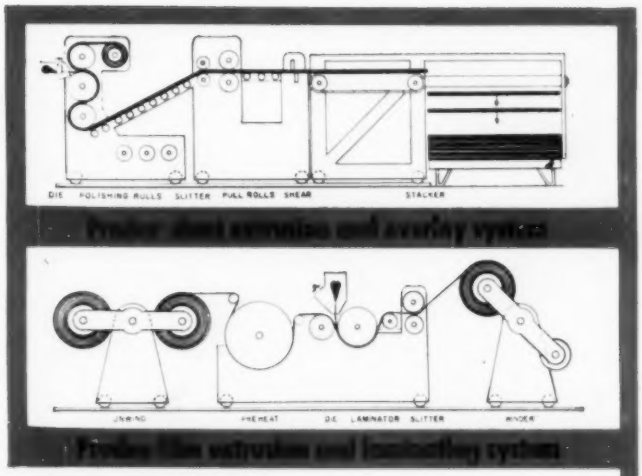

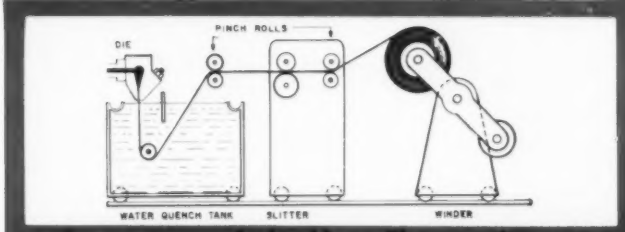

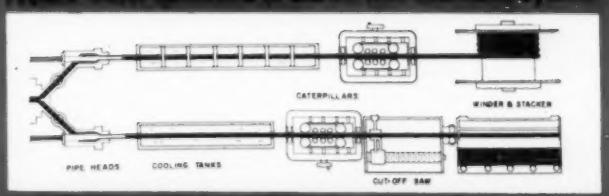

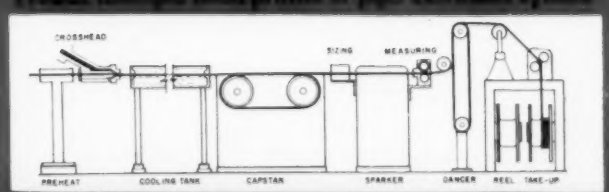

Designed for easier, more automatic operation and for faster capital return.

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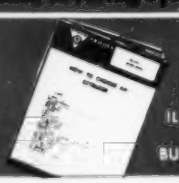
Manufacturers of Process and Extrusion Machinery

IN CANADA: Barnett J. Danson & Associates, Ltd., 1912 Avenue Road, Toronto 12, Canada



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Thermomat H-1818 pilot forming machine has a mold area of 1.5 sq. ft.

assist as optional extra. Instruments include pyrometer controller, timers, vacuum controller. High-capacity vacuum pump, surge tank, etc., are standard.

A pilot forming machine, the H-1818, has a maximum mold area of 1.5 ft. square; can draw to a depth of 6 inches. Drape mechanism is handily foot-operated. The 5.9-kw. heater is timer controlled. A ½-hp. pump and 12-gal. surge tank comprise the vacuum system. Price: $695. *Thermomat Co., Inc., 300 Maple Ave., Trenton 8, N. J.*

Medium injection machine

The Natco 300, modeled after its larger predecessor, the 400, (see M. PL., June 1957, p. 244), has a nominal shot capacity of 22 oz. of GP polystyrene, a plasticating capacity of 130 lb./hour. Interchangeable plungers and feed bushings make possible top injection pressures of either 20,000 or 30,000 p.s.i. The top clamping force of 325 tons can be reached in less than half a second. Clamping stroke is 24 in. (max.), daylight 42.5 inches. Rigid pieces up to 12 in. deep may be molded, in molds up to 33 by 21.2 in. in size. The 47.5-hp. hydraulic system, like that of the 400, has no large multi-way valves, but accomplishes change in direction of flow by smooth reversal of pump output, thus eliminating noisy and damaging hydraulic shock. *National Automatic Tool Co., Inc., Richmond, Ind.*

Vacuum metallizing stripper

Vac-Strip No. 3 is a liquid, miscible with water, that, in water solution at 160 to 212° F., will rapidly strip lacquer coats and metallizing from rejected parts and racks. Properly used, this nonflammable, nonvolatile liquid can strip metallized coatings from phenolics without damaging the plastic. Will derust steel parts and prevent rust from re-forming. *Chemclean Products Corp., 610 Warren St., Brooklyn 17, N. Y.*

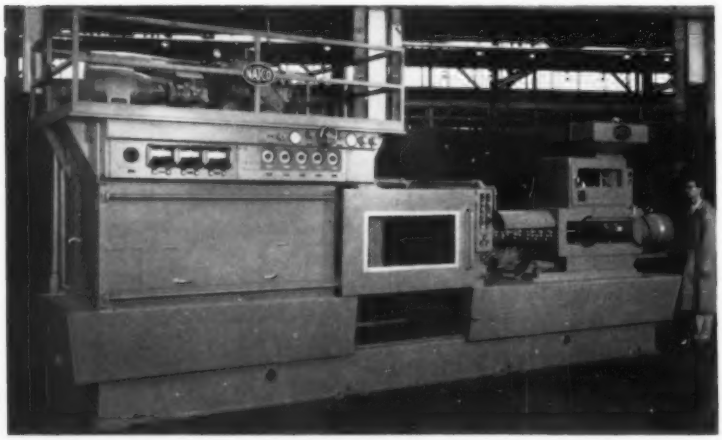
Two-component resin dispenser

A dual positive-displacement pump provides accurate metering and proportioning of resin and hardener in two-component systems such as are typically used in potting and reinforced molding. Components emerge separately, not mixed. Pumping may be accomplished by hand or by motor and reducer, and explosion-proof motors are available with unit, if desired. Dispensing valves are drip-proof. *Delsen Corp., 719 W. Broadway, Glendale 4, Calif.*

Small-parts molder

The Jet Plastic Molder is a bench-model, hand-operated injection machine, that features fast change-over; molds can be changed in less than 3 min., heating cylinders in less than a minute. Maximum shot capacity is about ½ oz. (¾ cu. in.); top molding pressure, exerted by a lever and toggle linkage, is 20,000 p.s.i. Mold clamping is independently accomplished with a separate lever and is adjustable—eliminating the V-block system used in most bench-model machines. Heaters consume 600 w. on 110 v. under control of thermoswitch that maintains operating temperature to within ±5° over the range from 200 to 600° F. Normal mold space is 3 by 4 in., 2.25 in. deep, but special sizes are possible. Over-all dimensions of molder are 30 in. high by 18 in. deep by 8 in. wide; weight is less than 100 pounds. A special floor stand is available, but the machine may be installed on a bench. *Unex Laboratories, Hathorne, Mass.*

Unex Jet Plastic Molder is a bench-model, hand-operated injection machine that features fast change-over



Natco 300 22-oz. injection molding machine, with 47.5-hp. power unit at top. Clamping stroke is 24 in. maximum

The NEW PRODEX HENSCHEL MIXER

THE NEW PRODEX-HENSCHEL MIXER

is used successfully in many installations here and abroad to prepare compounds ready for extrusion and molding, such as: **unplasticized rigid PVC dryblend, plasticized PVC dryblend, polyethylene colorant powder mix, cellulose acetate dryblend, PVC record compound, etc.**

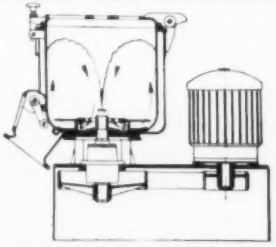
The PRODEX-HENSCHEL MIXER performs intensive dryblending and thorough dispersion of colors, pigments, fillers, stabilizers and/or plasticizers with plastics powders or granules.

It permits, if desired, the mechanical (frictional) heat-up of plastics powders faster and more uniformly than by conduction or radiation.

The unique principle of fluidizing dry powders so that they can be mixed like liquids, plus controlled shearing action, result in mixing quality and mixing speeds heretofore not obtained.

Design and Operation of the PRODEX-HENSCHEL MIXER

A cage-like ring of pins rotates concentrically around a stationary ring of pins. The rotating member also carries specially shaped blades and impellers which aerate and propel the powders to be mixed. The action is similar to that of a high-speed stirrer. The aerated powders or granules flow downward through the center of the rotating ring and pass through the zone of shearing between the rotating and stationary pins. The blend then moves upward along the wall of the mixing chamber. The entire batch rotates slowly around the axis of the mixing chamber. The rotating member of the mixing mechanism is usually operated at peripheral speeds of 100 to 200 ft/sec. The spacing between the rotating and stationary pins determines the shearing action. The shearing action controls mixing and dispersion as well as mechanical heat-up.



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ASK FOR BULLETIN M1

Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Chemie Wirtschaft in Zahlen"

Published in 1958 by Econ-Verlag G.m.b.H., Pressehaus, Duesseldorf, Western Germany. 160 pages. Price: DM 9.80 (ca. $2.50).

This third, completely revised edition of statistics relating to the chemical industries throughout the world, was compiled from government sources of the countries discussed, and was prepared by the Statistical Dept. of the German Chemical Industry Assn. (Referat Statistik, Verband der chemischen Industrie, e.V.) The pocket-book size volume is divided into two parts. The first part contains tables relating the German chemical industry to the economy of the country as a whole. The second part is an international section which provides comparable data on production, export, and import of the chemical industries of almost all countries of Europe.

"Directory of Independent Commercial Laboratories Performing Research and Development 1957," National Science Foundation publication NSF 57-40.

Published in 1958 by the U. S. Government Printing Office, Washington, D. C. 60 pages. Price: 40 cents.

This is a companion book to the National Academy of Sciences directory, published in 1956 by the National Research Council (Pub. No. 379, price $10), "Industrial Research Laboratories of the United States." NRC 379 is a 550-page volume listing the names, addresses, sizes, names of chief staff members, and descriptions of research activities of 4060 industrial laboratories. There is also a geographic listing by cities, and a good listing by subjects. Whereas NRC 379 lists mostly "captive" labs, NSF 57-40 lists only those laboratories whose services may be contracted for. More up to date than NRC 379, it also has geographical and subject indexes.

"France Plastiques"

Published in 1958 by Société de Créations Editions et Productions Publicitaires, 27, Rue Laffitte, Paris 9e, France. 1114 pages. Price: 2800 F. ($7.00).

Enlarged to give additional information on the French plastics industry, this 10th edition of the annual yearbook includes a listing of materials makers, machinery and equipment manufacturers, molders, fabricators, importers, and distributors. Also included are listings of trademarks, manufacturers' societies, educational institutions, personalities, etc.

"Enciclopedia Annuario delle Materie Plastiche" (Plastics Encyclopedia and Year Book—2nd Edition)

Published in 1958 by Editrice L'Industria, Via Farneti 8, Milano, Italy. 1200 pages. Price: L. 3900. (ca. $6.29).

The second annual edition of this Italian encyclopedia includes 37 chapters on artificial resins, fillers, plasticizers, stabilizers, solvents, etc.; 8 chapters on machinery and equipment; 13 chapters on processing methods; and 19 chapters on applications. Contains over 2200 names of suppliers and manufacturers of plastics products, as well as 6400 proprietary names with addresses of the manufacturers.

Paper thermometers. Description, uses, etc., of a line of Thermopaper and Thermotube disposable paper temperature indicators for use in the plastics and other industries. Offered in range of 100 to 490° F. Used for measuring temperatures between the jaws of plastic film heat sealers, of resin during coating and finishing operations, of rolls in film laminating, etc. 6 pages. *The Paper Thermometer Co., 10 Stagg Dr., Natick, Mass.*

Color slides on molding. Set of 38, 35-mm. color slides for use in training injection molding machine operators. Slides and narrative describe principal steps in injection molding. Booklet containing illustrations of slides and text also available. *Polymer Products Div., Foster Grant Co., Inc., Leominster, Mass.*

Film on the farm. "Production Protection and Profits on the Farm" is a 30-min., 16-mm. sound film in color showing how polyethylene film can be used profitably on the farm. Available without charge to individuals and groups. *Advertising Dept., Visking Co., Plastics Div., 6733 W. 65th St., Chicago, Ill.*

Epoxy resins. Series of photographs showing how to cast epoxy resin vacuum-forming molds. 4 pages. *Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City, N. J.*

Teflon rod stock. Sizes; electrical, mechanical, and chemical properties; applications; etc., for Chemfluor, a line of Teflon rod stock. Fact Sheet 1. 4 pages. *Chemplast, Inc., 3 Central Ave., East Newark, N. J.*

Product catalog. Characteristics, applications, and prices of a variety of plastics in the form of sheets, rods, tubes, balls, liquid, and film. 76 pages. *Auburn Plastic Engineering, 4916 S. Loomis St., Chicago 9, Ill.*

Polypropylene. "Injection Molding and Extrusion of Moplen" gives technical information obtained in actual production runs with this new isotactic polymer. Includes causes and remedies for difficulties or faults. Technical Bulletin 1. 8 pages. *Chemore Corp., 21 West St., New York 6, N. Y.*

Banbury Mixers. Sizes, applications, design and construction, capacities, rebuilding and repair-

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"Mylar" offers a unique combination of properties that may help you improve performance and lower costs of *your* product. Here are two of the many important properties for evaluation:

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NATIONAL BREWING REPORTS . . .

Tough, washable surface of Du Pont Mylar® improves appearance . . . extends life of returnable cartons

PROBLEM: As with most users of returnable cartons, National Brewing Co., Baltimore, wanted to cut the cost of replacing worn-out cartons. They were looking for a way to keep cartons attractive and appealing to the eye for longer periods of time.

SOLUTION: After extensive field tests with other materials, National Brewing found that only Du Pont "Mylar"† polyester film—laminated to printed board stock*—provided the necessary performance characteristics.

RESULTS: The laminated surface of "Mylar" has helped National Brewing extend the life of returnable cartons . . . cut replacement costs. "Mylar" makes the colors sparkle . . . it helps accentuate brand identification. From a performance standpoint, tough, durable "Mylar" resists scuffing, dirt and moisture . . . cartons are kept clean and sparkling. What's more, surface grime can be washed off periodically without danger to carton structure or printing.

HOW CAN "MYLAR" HELP YOU? Cartons surfaced with "Mylar" are just one of the many ways this versatile film is being used to improve existing products, create new ones. For example, "Mylar" is also a remarkably efficient electrical insulator . . . a base for a tougher, more durable magnetic recording tape. To find out how you can capitalize on the outstanding properties found in "Mylar", be sure to mail the coupon today.

DU PONT

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DU PONT **MYLAR**® POLYESTER FILM

†**"MYLAR"** *is Du Pont's registered trademark for its brand of polyester film.*
**Lamination engineered by the Arvey Corporation, Jersey City.*

☐ Please send me information on properties, applications and types of "Mylar" available (MB-11).

☐ Please send me information on surfacing materials made with "Mylar" polyester film (MB-7).

E. I. du Pont de Nemours & Co. (Inc.)
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Application_____

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Automatic Cycle Speed—50 to 500 p/h
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Automatic Mold Heat Control: ± 1°
Automatic Hopper—For Accurate Feeding
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ing, etc., of Banbury mixers. Bulletin 207. 36 pages. *Farrel-Birmingham Co., Inc., Ansonia, Conn.*

Technical services. Pictorial essay on the designing and building of chemical and petrochemical plants, and the development of chemical processes. 26 pages. *Scientific Design Co., Inc., 2 Park Ave., New York 16, N. Y.*

Polyethylene. Physical properties, melt index, characteristics, applications, etc., of five types of Rigidex polyethylene. Technical Information Sheet 1. 4 pages. *British Resin Products, Ltd., Devonshire House, Piccadilly, London, W.1, England.*

Mills and homogenizers. Sizes, specifications, etc., for over 100 dispersers and homogenizers for particle size reduction. 6 pages. *Tri-Homo Corp., 98 Highland Ave., Salem, Mass.*

Nylons. Physical and chemical properties, applications, fabrication, injection molding processes, etc. for Ultramid A, AK, and AE thermoplastic 6/6 polyamide resins from Badische Anilin-& Soda-Fabrik AG., Ludwigshafen, Germany. In German. 20 pages. *BASF, Inc., 375 Park Ave., New York 22, N. Y.*

Adipic acid. Physical and chemical properties, suggested uses, etc., for adipic acid, which has varied uses in the plastics and other industries. TB-I-12R. 36 pages. *National Aniline Div., Allied Chemical Corp., 40 Rector St., New York 6, N. Y.*

Kel-F resins. Applications, molding techniques, formulations available, properties, etc. for Kel-F halofluorocarbon products. 8 pages. *Minnesota Mining & Mfg. Co., Jersey City Chemical Div., P. O. Box 477, Jersey City 3, N. J.*

Plastics tooling. Applications, advantages, etc., of reinforced plastics as a low cost, light weight tooling material. 8 pages. *Arvin Industries, Inc., Columbus, Ind.*

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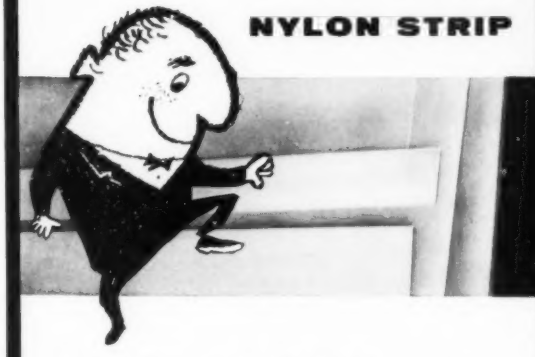

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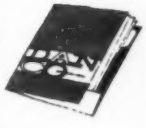

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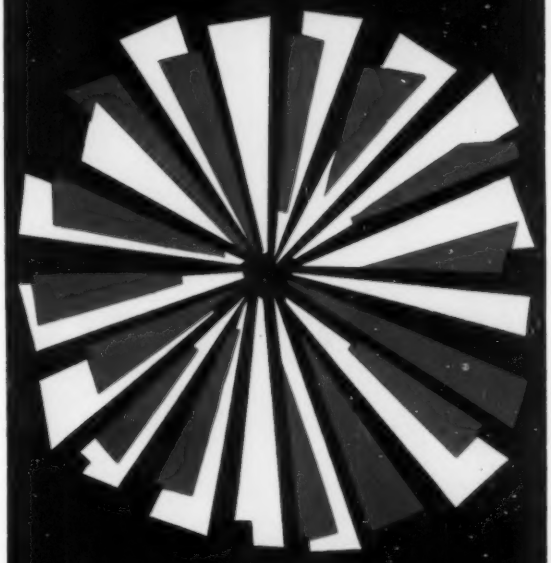

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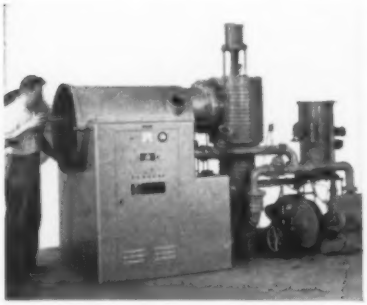
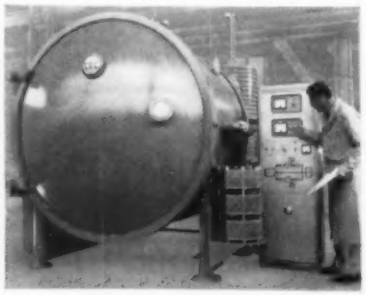
We'll be glad to send you bulletins on our line of coaters, and share our experience in helping you set up operations.



30″ coater—model LC1-30

Typical production: 400 1½″ diameter pieces per cycle; 5 to 7 cycles per hour.



72″ coater—model LC1-72

Accommodates pieces 22″ by 50″ on each of six stations; 5 to 6 cycles per hour.

Smaller coaters are available for production coating of optics or other small parts, and for laboratory and pilot plant work.

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Rochester Division, Rochester 3, N.Y.

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

CEC

etc., for HPM 450-P-80 preplasticating injection machine for molding plastics. Bulletin 58P80. 6 pages. *The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*

Production facilities. Describes parts design, material selection, mold making, and compression or transfer molding of custom molded thermosetting plastic parts, and other services of this company. 4 pages. *Kurz-Kasch, Inc., 1415 S. Broadway, Dayton 1, Ohio.*

Motion picture index. "Motion Picture Film Catalogue of the Plastics Industry" lists some of the movies and film strips available from SPI and its members. 22 pages. *The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.*

Drives. Specifications, motor control cabinet dimensions, accessories, uses, etc., of Reliance V*S drives for precise, adjustable machine speeds in the plastics and other industries. 16 pages. *Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.*

Epoxy resin. Features, applications, working instructions, physical properties, etc., for Maraset resin No. 532, a contact-pressure, two-component and solvent-free epoxy adhesive. 1 page. *Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N. Y.*

Polyethylene. Properties, advantages, preparing emulsions for textile applications, industrial applications, drying and curing, washing, etc., of Emulsifiable A-C polyethylene. 18 pages. *Semet-Solvay Petrochemical Div., Allied Chemical Corp., 40 Rector St., New York 6, N. Y.*

Strippers. Description of noninflammable strippers used for the removal of surface coatings of vinyls, epoxies, urethanes, phenolics, synthetic rubbers, etc. 4 pages. *The Gregg Co. Inc., Broad St., E. Riverton, N. J.*

High-impact material. Properties, applications, molding procedures, finishing, etc. for Durez

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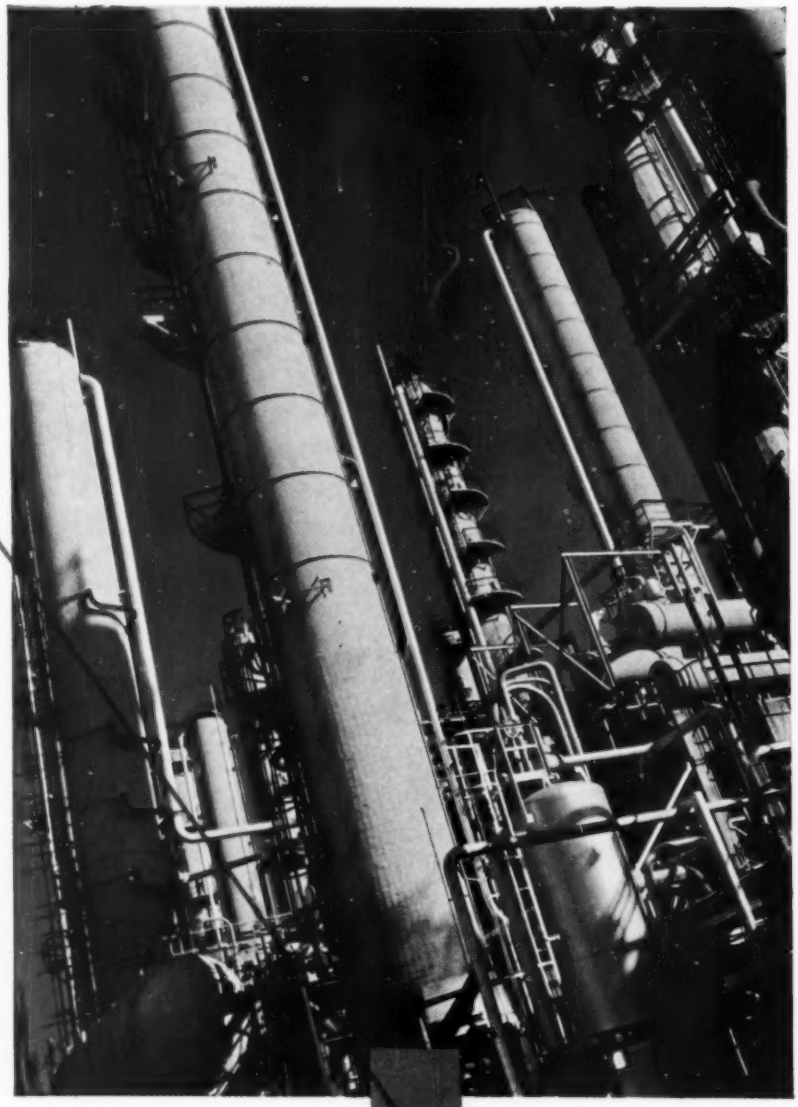

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95% minimum purity

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We invite inquiries for domestic tank-car and overseas ocean-tanker shipments of these C_4 hydrocarbons. We also will welcome discussion of commercial-volume production of other related petrochemicals.

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18683, a two-stage sisal-filled, high-impact phenolic. 4 pages. *Durez Plastics Div., Hooker Chemical Corp., N. Tonawanda, N. Y.*

Vinyl stabilizers. Technical data on the stabilizing of all forms of vinyl products, including rigids, flexible vinyls, plastisols, and organosols; expanded vinyls; homogeneous tile; and asbestos tile. The problems of light stability, water fogging, sulfur staining, exudation and blooming, plateout, lubrication, viscosity build-up and air release, mold growth, copper staining, and similar subjects are also discussed. 40 pages. *Ferro Chemical Co., Bedford, Ohio.*

Polypropylene. Available types; colors; general, thermal, mechanical, permanence, and electrical properties; chemical resistance; applications; product and mold design; injection molding characteristics; processing and fabrication; etc., of Pro-fax polypropylene. 10 pages. *Hercules Powder Co., Wilmington 99, Del.*

Saw blades and cutting tools. Body styles, tooth forms, advantages, recommendations, and other technical data necessary to determine the specific style of carbide-tipped blade and tooth series needed for plastics, aluminum, and non-ferrous alloys. Catalog NF4-4. 4 pages. *North American Products Corp., Center Grove Rd., Edwardsville, Ill.*

Polyvinyl acetate emulsions. "Textile Finishing with Celanese Polyvinyl Acetate Emulsions" gives description of emulsions, application procedures, sources, etc., in finishing fabrics of cotton and man-made fibers. Bulletin NP-28. 8 pages. *Plastics Div., Celanese Corp. of America, 744 Broad St., Newark 2, N. J.*

Corrosion resistance. Applications, properties, etc., for a line of corrosion-resistant plastics fabrications and coatings, components, semi-finished materials, fabricating equipment, and laboratory ware. 4 pages. *American Agile Corp., P. O. Box 168, Bedford, Ohio.*

for

WIRE *and* CABLE INSULATION

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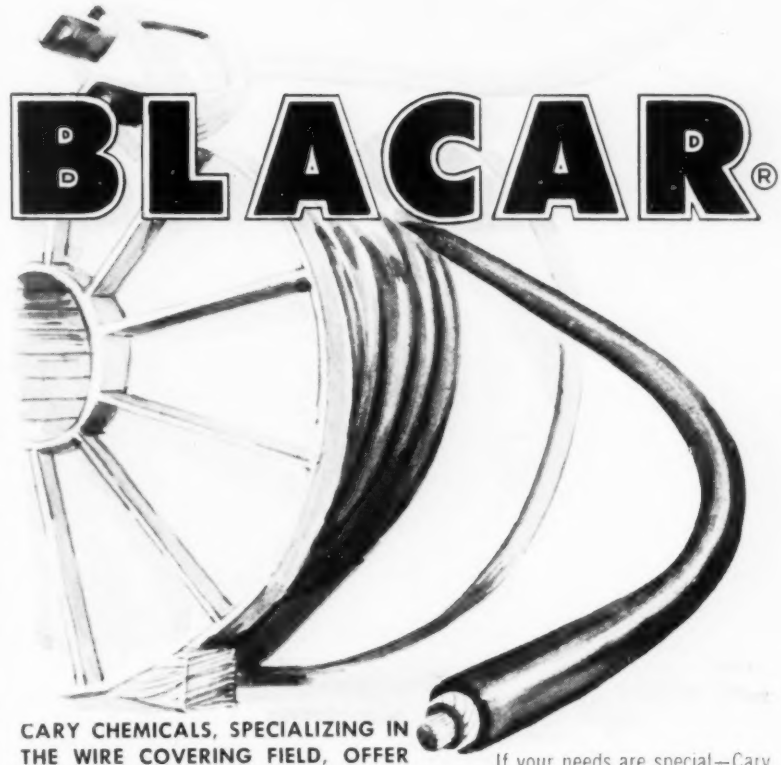

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BLACAR® 2700: UL-approved primary insulating material designed for low cost building wire applications—specifically: T, TW, TF, TFF, type wire (including oil exposure at 60°C).

Provides excellent processing features, high extrusion rates, good electrical properties, plus a smooth glossy finish. Ideal for use as a general-purpose material for a wide range of low-tension wires and cables.

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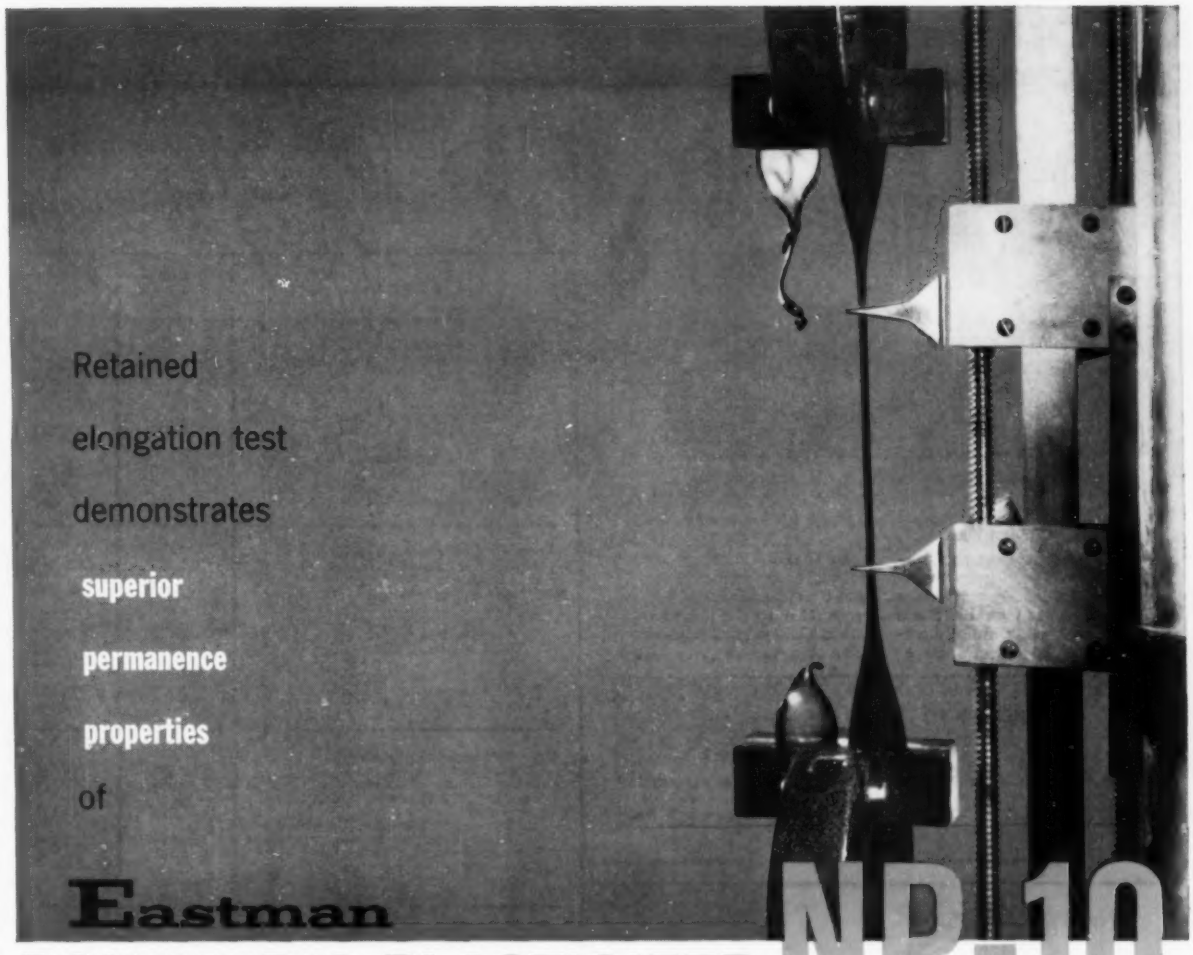

POLYMERIC PLASTICIZER NP-10

You are looking at a photograph of two vinyl test samples, both containing 50 parts of plasticizer per hundred parts of resin. The one at left is plasticized with DOP, the one at right with Eastman Polymeric Plasticizer NP-10.

To provide a basis for observing changes in physical properties due to heat aging, the ultimate elongation values of control samples containing these plasticizers were first established. Duplicate samples were then placed in an air-circulating oven for seven days at 120°C. After heat aging, the samples were placed in a tensile machine and their retained elongation determined.

The DOP plasticized vinyl sample retained only 75% of its initial elongation. The NP-10 plasticized sample, on the other hand, was unaffected by aging at elevated temperatures, exhibiting a retained elongation of 100%.

Providing long term plasticity at elevated temperatures is only one of NP-10's excellent permanence characteristics. This primary polymeric plasticizer is highly resistant to hydrolysis. Its loss from vinyl films to hydrocarbons, soapy water and activated charcoal is extremely low.

NP-10 exhibits permanence properties equal or superior to those of higher molecular weight plasticizers, yet it is a compound of relatively low molecular weight. As a result, NP-10 blends easily and rapidly, permitting vinyl compounders to obtain maximum permanence characteristics while maintaining efficient production schedules.

As a vinyl plasticizer, Polymeric Plasticizer NP-10 shows little tendency to migrate to other materials. Its effect on easily-crazed surfaces such as polystyrene is extremely low. NP-10 is colorless and provides good low temperature flexibility.

If you are looking for an ideal primary plasticizer, one that combines maximum permanence with ease of processing, investigate Eastman Polymeric Plasticizer NP-10. Write to EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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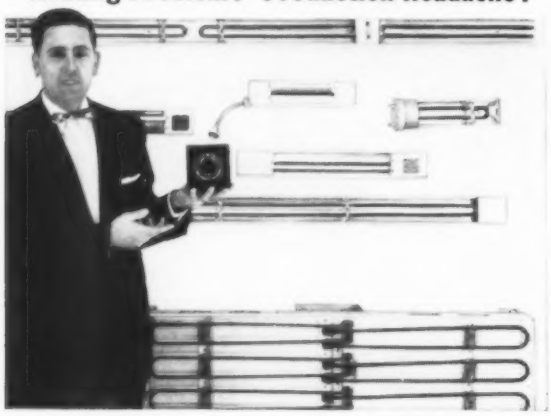

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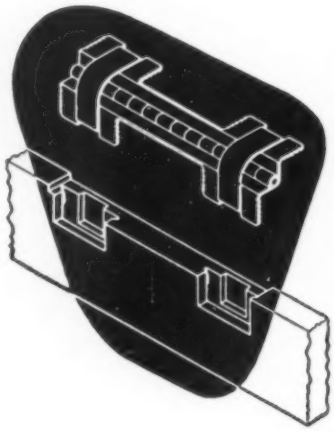

GEISSEL *Mfg. Co., Inc.*
109 LONG AVENUE
HILLSIDE, N. J., U. S. A.

mp Plastics

Production and sales figures in 1000 lb.[a] for May and June 1958

Materials	Total p'd'n first 6 mos. of 1958‡	Total sales first 6 mos. of 1958‡
Cellulose plastics:[a]		
Cellulose acetate and mixed esters:		
Sheets, under 0.003 gage	8,607	8,527
Sheets, 0.003 gage and over	9,177	8,301
All other sheets, rods, tubes (including other cellulose plastics)	4,319	3,848
Molding, extrusion materials (including other cellulose plastics)	39,970	39,120
Nitrocellulose sheets, rods, tubes	1,622	1,760
Other cellulose plastics[g]	3,056	2,209
Phenolic and other tar-acid resins:		
Molding materials[a]	77,392	71,903
Bonding and adhesive resins for:		
Laminating (except plywood)	28,558	18,552
Coated and bonded abrasives	6,183	5,123
Friction materials (brake linings, clutch facings, etc.)	5,878	5,107
Thermal insulation	21,952	21,440
Plywood	23,598	19,872
All other bonding uses	17,930	17,816
Protective coating resins	13,751	11,897
Resins for all other uses	13,926	10,641
Urea and melamine resins:		
Textile-treating resins	16,508	15,440
Paper-treating resins	12,605	10,700
Bonding and adhesive resins for:		
Plywood	42,324	43,312
All other bonding and adhesive uses, including laminating	20,004	17,684
Protective-coating resins	13,741	10,961
Resins for all other uses, including molding	46,464	43,183
Styrene resins:		
Molding materials[a]	199,165	214,896
Protective-coating resins	44,430	43,498
Resins for all other uses	74,975	59,388
Vinyl resins, total[b]	358,972	357,122
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		35,246
Sheeting (resin content)		28,469
Molding and extrusion (resin content)		93,476
Textile and paper treating and coating (resin content)		26,478
Flooring (resin content)		53,285
Protective coatings (resin content)		14,557
All other uses (resin content)		26,026
All other vinyl resins for:		
Adhesives (resin content)		22,332
All other uses (resin content)		57,253
Coumarone-indene and petroleum polymer resins	111,778	110,194
Polyester resins:		
For reinforced plastics	50,165	45,612
For all other uses	5,492	5,086
Polyethylene resins total:	410,288	374,437
For film		150,059
For all other uses		224,298
Miscellaneous:		
Molding materials[a, d]	18,721	19,256
Protective-coating resins[e]	6,585	3,863
Resins for other uses[f]	70,861	60,707

*Dry basis designated unless otherwise specified.
†Revised.
‡Partially estimated.
[a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c]Includes data for spreader and calendering-type resins.

Production

From statistics compiled by the U. S. Tariff Commission

May†		June†	
Production	**Sales**	**Production**	**Sales**
1,344	1,381	1,788	1,744
1,536	1,432	1,403	1,554
†757	†628	851	676
†6,874	†6,833	6,176	5,841
246	271	231	245
†11,752	†11,449	11,759	11,221
†4,159	†2,775	4,869	3,095
818	813	850	822
847	636	1,092	1,010
3,960	4,329	3,424	3,585
4,061	3,319	4,025	3,371
†2,434	†2,445	2,786	2,833
2,085	1,991	2,120	2,296
2,246	1,829	2,370	2,007
2,559	2,344	2,396	2,270
1,812	1,668	2,003	1,978
7,204	7,886	7,430	6,908
†3,747	2,580	3,211	3,028
2,225	1,834	2,453	2,028
7,894	6,805	6,009	6,110
36,372	42,556	35,394	33,322
7,298	7,497	7,748	7,461
12,142	9,706	12,119	8,503
†56,785	†62,799	57,749	62,355
	†5,534		5,986
	†5,331		5,716
	15,958		16,205
	4,769		5,462
	10,347		9,117
	2,518		2,518
	5,519		4,020
	†3,675		3,932
	†9,149		9,399
18,881	19,209	17,672	17,143
9,913	9,051	9,437	8,470
956	989	1,306	1,089
70,963	61,584	68,068[b]	63,547
	23,670		23,489
	37,914		40,058
3,221	3,227	3,623	3,596
1,160	714	1,523	719
12,612	10,810	11,721	10,627

[a]Includes data for acrylic, nylon, and other molding materials. [e]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [r]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses. [s]This classification discontinued in May and this material, mostly ethyl cellulose, reported in sheets and molding material. [b]7.3% produced by low-pressure process.

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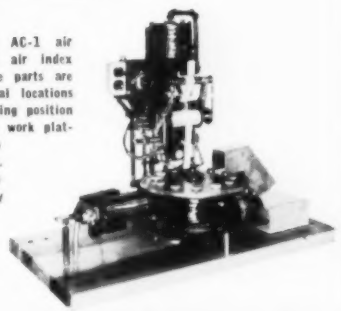

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- Is it true that barrel electroplated plastics look and feel like solid metal?
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- Is the coating pure metal? Permanent and non-peeling?
- Does the metal plate improve the strength of the product?
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- Can you metallize plastics up to 2 ½ inches in size?
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COMPANY, INC. DEPT. M

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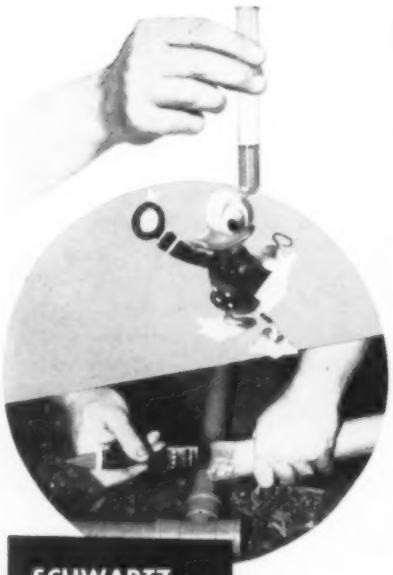

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Termite control with polyethylene pipe

Permanent termite protection for newly erected homes or buildings can be achieved with the use of a unique new system based on polyethylene pipe. The basic idea is to install a system of polyethylene tubing in the gravel bed over which the concrete slab foundation is poured. The tubing is slotted at regular intervals and connected to short lengths of PVC pipe which extend beyond the outside wall. With such a system in place, the building can be treated at any time for protection against termites.

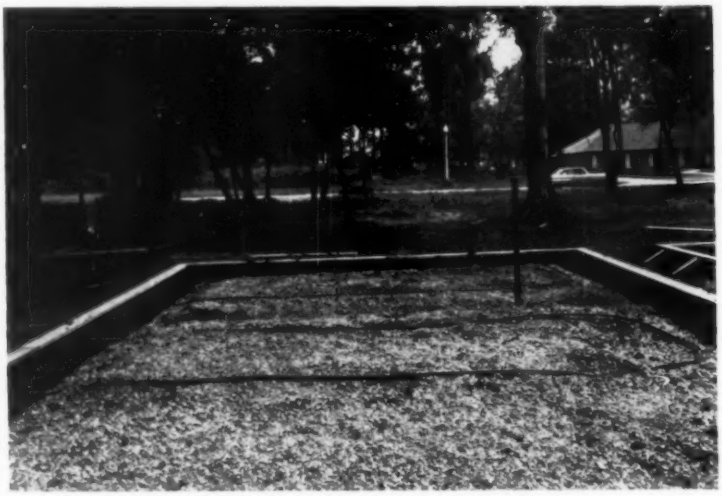
In conventional methods of termite control, a solution is sprayed on the gravel base before the concrete slab is poured. This initial spraying, however, is said to last a maximum of six years as a general rule.

The new method, called the Sure-Tox system, was developed by Paul S. Foster of Louisiana Termite Control Co., Baton Rouge, La. First experiments with the system involved the use of steel pipe, which was unsatisfactory because it allowed the liquid preventative to escape in abundance from the holes nearest the outlets and not reach the farther places under the foundation. After a time, the pipes clogged with gravel and solution mixture and tended to deteriorate.

The inherent flexibility of polyethylene accomplished the goal. Using ½-in. tubing, slits ¼ in. long are made every 6 in. in a staggered pattern. Each end of the tube is connected to an adapter which in turn connects to the outside PVC pipe. The tube sections, bent to horseshoe shape, are placed 5 ft. apart on the gravel fill over the entire foundation. Additional sections of tubing are placed around plumbing, at expansion joints, and in other potentially hazardous locations.

At any time in the building's life, termite treatment is simple. An exterminating solution is forced into the plastic pipe until it is completely filled. The slits remain closed until additional pressure is applied, when they are forced open and the insecticide flows evenly over the entire gravel base of the foundation.

The cost of installing the Sure-Tox system, including the initial spray of insecticide, is $145 for a 1500 sq. ft. house. And this installation is only about $85 more than the cost of the usual initial treatment.—END



Polyethylene tubing, in horseshoe-shaped sections, is installed in the gravel bed of a new home. This tubing will be covered with more gravel and then the cement foundation will be placed on top. This tubing connects to outlets on the far left so that termite control treatments can be made at any time by forcing exterminating solutions under pressure over the surface of the foundation base

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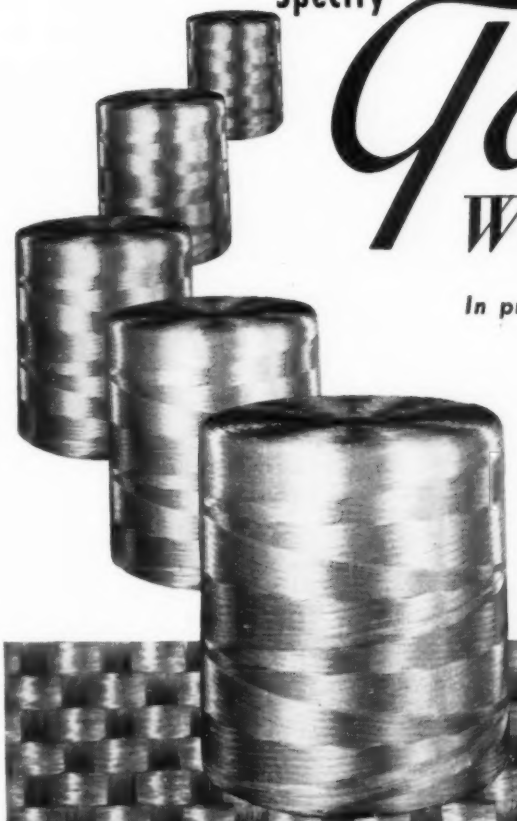

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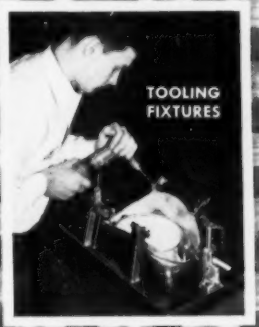
- **CONFORMS WELL TO THE MOLD**

RESULT:

Stronger Reinforced Plastic Products at Less Cost; Increased Sales Acceptance



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Appearance	Clear Liquid or White Solid
Color, APHA	100 max.
Odor	Mild
Specific Gravity 30/20°C.	1.055±0.003
Free Acidity, as Acetic Acid	0.10% max.
Ester Content	99.0% min.

Major uses:

A plasticizer in polyvinyl resins and copolymers, polyvinyl butyral and butadiene—acrylonitrile rubbers.

Dimethyl Sebacate

Extreme efficiency • Excellent low temperature properties

Appearance	Clear Liquid or White Solid
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Odor	Neutral
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Free Acidity, as Acetic Acid	0.02 max.
Ester Content	99.0% min.

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COMPRESSION AND CAVITY MOLD SETS. 6-page catalog pictures and lists lines of cavity plate sets for compression and injection molding. Includes diagrams, specifications, prices. National Tool & Mfg. Co. **(J-802)**

ORGANIC PEROXIDES. Technical bulletin catalog describes properties of a line of organic peroxides for polymerization of monomers and silicones, catalyzing, bleaching, etc. Includes uses, specifications, handling, storage, and shipping information. Cadet Chemical Corp. **(J-803)**

EXTRUDERS. 4-page folder pictures and describes a line of five electrically heated, air-cooled extruders capable of achieving pressures up to 10,000 psi. Also discusses 6 in. by 13 in., 2-roll laboratory mill. Johnson Machinery Co. **(J-804)**

POURED-IN-PLACE PLASTICS UNIT. Illustrated folder describes the "Nopcometer", an automatic unit for metering, mixing, and delivering up to 15 lb. of "Lockfoam" plastics formulations per minute. Plastics Div., Nopco Chem. Co. **(J-805)**

ROTARY MOLDING PRESSES. Illustrated 4-page folder describes features of lines of hopper-fed, 10 and 30-station automatic rotary molding presses for producing parts used in appliances, toys, instruments, etc. New England Butt Co. **(J-806)**

ANTI-STATIC MOLD RELEASE. Catalog sheet describes an inert, invisible coating that eliminates static charges on dies, lubricates them, and prevents them from rusting. Lists prices. Optics Mfg. Corp. **(J-807)**

LOW-PRESSURE TANKS. Illustrated release describes features of a line of electrically heated, low-pressure tanks for spraying, pressure or vacuum impregnating, and conveying melted compounds to distant points. Sta-Warm Electric Co. **(J-808)**

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POLYPROPYLENE FACT BOOK. Illustrated 10-page booklet describes properties and applications of lightweight "Pro-fax" polypropylenes for extrusion, coating, vacuum forming, compression and transfer molding, etc. Includes processing, design, and other data. Hercules Powder Co., Inc. **(J-810)**

MOLDING EQUIPMENT. Engineering data sheet file contains features, specifications, and prices for a line of aerosol mold release and anti-rust agents, a line of super-heaters for Reed-Prentice machines, and ball and pineapple-type mixing and terminal plasticizing nozzles. Injection Molders Supply Co. **(J-811)**

PVC RESINS. 52-page booklet discusses properties, handling, and applications of the "Vygen" family of polyvinyl chloride resins. Describes roles of plasticizers, stabilizers, colorants, fillers, and lubricants. Methods of processing, testing are also discussed. General Tire & Rubber Co. **(J-812)**

INJECTION MACHINES. Illustrated 40-page catalog describes line of injection presses with ½- to 1-oz. capacities. For small and specialty items, plastic molding over inserts, laboratory test samples, design and production, short or moderate runs. Newbury Industries, Inc. **(J-813)**

HYDRAULIC VALVES. Illustrated data sheet folder describes lines of direct and reverse-acting, 0 - 3,000 lb. control valves with V-ported seats for water (hot or cold), oil, steam, air, and gas. Includes valve capacity charts for steam, liquids, and gases. Sinclair-Collins Valve Co. **(J-814)**

CAST ACRYLIC SHEETS. 4-page leaflet describes the properties of a precision cast acrylic sheet with close thickness tolerances and high optical clarity for windshields, signs, domes, cake box covers, etc. Cast Optics Corp. **(J-815)**

PLASTIC DYESTUFFS. Brochure pictures and describes uses of this company's lines of lacquers, dyes, adhesives, and cleaners, for acrylics, butyrate, styrene, vinyls, etc. Schwartz Chemical Co., Inc. **(J-816)**

CONVERTING MACHINERY. Illustrated 24-page booklet describes lines of plastics processing machinery. Includes converting machines, coaters, laminators, slitter-rewinders, winders, printing presses, embossers, etc. Dilts Div., Black-Clawson Co. **(J-817)**

AUTOMATIC INJECTION PRESS. Illustrated 4-page folder presents features and specifications of a ½-oz. capacity plastic injection press with automatic cycling from 50 to 500 dry cycles per hour. Simplomatic Mfg. Co. **(J-818)**

EPOXY CURING AGENTS. Technical data sheets describe the properties and applications of dicarboxylic acid anhydrides as curing agents for epoxy resins. Include formulations, curing schedules, handling information, etc. National Aniline Div., Allied Chemical Corp. **(J-819)**

INJECTION MOLDING MACHINES. Illustrated 4-page booklet presents construction and operational features of hand and power-operated, 10 and 15 gram injection molding machines. Includes specifications. Dowding & Doll, Ltd. **(J-820)**

LAMINATING PRESSES. Illustrated 4-page brochure describes features of lines of self-contained, hand-operated presses for laminating flat inserts, such as cards, tags, charts, photos, etc., at rates up to 150 per hour. Fred S. Carver, Inc. **(J-821)**

REINFORCING RESIN. 4-page technical bulletin presents properties and advantages of the use of a granular, styrene-butadiene copolymer in natural and synthetic rubber formulation. Includes tables, graphs. Chemical Div., The Goodyear Tire & Rubber Co. **(J-822)**

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NYLON RESINS. Illustrated 56-page booklet discusses the properties, design possibilities, applications, and advantages of "Zytel" nylon resins. Includes injection molding, extrusion, and wire coating techniques. E. I. du Pont de Nemours & Co., Inc. **(J-824)**

ELECTROFORMED MOLDS. 4-page illustrated brochure discusses electroforming operations and their applications and advantages for close tolerance work, finishes, difficult hobbing jobs, slush molds, raised engravings, etc. Electromold Corp. **(J-825)**

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GLASS FIBER ROVING. Illustrated 8-page folder describes case history applications of Garan, Vitron and chrome roving for rod stock, molding compounds, mat, preforming, woven roving, etc. L.O.F. Glass Fibers Co. **(J-827)**

VINYL STABILIZERS. Illustrated folder describes properties and applications of vinyl stabilizers. Presents recommended formulations for plastisol foam and sponge, spread and dip coatings, slush and centrifugal molding compounds, etc. The Harshaw Chemical Co. **(J-828)**

HYDRAULIC PRESSES. 18-page catalog describes and illustrates this company's lines of hot plate, downward acting, and transfer molding presses; forming and drawing presses; etc. Includes technical data tables. The French Oil Mill Machinery Co. **(J-829)**

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TOOLING PLASTICS. Illustrated 4-page bulletin describes advantages of this company's epoxy tooling resins for plastics tool manufacture in the aircraft, automotive, metal trades, etc., industries. Furane Plastics, Inc. **(J-837)**

ROLL PRINTERS. Illustrated specification sheet presents construction and operational features of a line of printing machines for marking plastics and other materials in sheet, strip, or tube form. Markem Machine Co. **(J-838)**

FLEXIBLE CASTING RESIN. Technical bulletin describes properties of an epoxy flexible casting resin which sets at room temperature. For potting and encapsulating of electronic components, production of molds, and as facings for drop hammer dies. Marblette Corp. **(J-839)**

REINFORCED MOLDING COMPOUNDS. Illustrated folder gives price data for lines of styrene and nylon reinforced injection molding compounds. Includes color, shipping, delivery information. Fiberfil, Inc. **(J-840)**

CUSTOM MOLD FABRICATION. Illustrated 4-page folder describes advantages of this company's process for custom fabrication of mold and die components, cavities and cores, hobs, and inserts direct from original patterns in almost all castable metals. Manco Products, Inc. **(J-841)**

VERTICAL INJECTION PRESS. Illustrated 4-page bulletin diagrams components and presents specifications of a 4- to 6-oz., 15 hp. vertical injection molding machine with a plasticizing capacity of 75 lb. per hour. Improved Machinery, Inc. **(J-842)**

EXTRUSION EQUIPMENT. Illustrated 20-page booklet describes features of lines of extruders, pull-off units, conveyors, automatic cutters, drawing and winding take-up units, grinding mills, and other extrusion equipment. Negri Bossi & C. **(J-843)**

PLASTIC SHEETING. 4-page leaflet outlines the types, formulations, and uses of this company's light, medium, and heavy gauge "Kodapak" thermoplastic cellulose ester sheeting. Eastman Kodak Co. **(J-844)**

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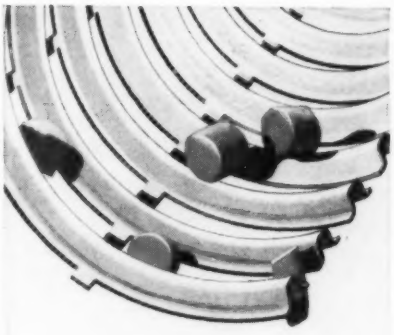
RP epoxy compound

A new reinforced epoxy resin compound which promises high strength coupled with exceptional formability has been announced by Minnesota Mining & Manufacturing Co., St. Paul, Minn. For compression or transfer molding, the product will give an average flexural strength of 100,000 p.s.i., an average tensile strength of 40,000 p.s.i., and an average compressive strength of 38,000 p.s.i., at normal temperatures, according to 3M.

The compound is being used in the aircraft manufacturing field where high strength/weight ratio is important. Because of the tendency of its fibers to distribute evenly under pressure, the product—called Scotchply molding compound type 1100—is said to be ideal for making complex parts which previously required hand lay-up or machining.—END

Reinforced epoxy resin compound for transfer or compression molding (shown in bulk form around figures) gives even distribution of glass fibers (portion of sphere at top), can be molded at inside and outside corners (part in center), and will allow molding of sections with deep draws (bottom). (Photo, 3M)

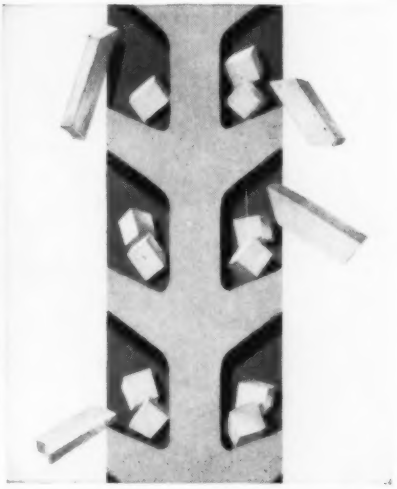
Lately more plastics materials are being sized and separated by Simon-Carter machines



CARTER GRADERS PERFORM THICKNESS, WIDTH SEPARATIONS

For sizing or separating free-flowing granular materials by *thickness*, Carter Precision Graders use revolving cylinders with *slotted perforations at the bottom of grooves*. Saddles between these grooves upedge the materials presenting them to the slots in an edgewise position. The thinner pieces pass through and the thicker pieces pass over and are conveyed to the end of the machine.

For *width* sizing or separating the Precision Graders use revolving cylinders with *round recessed perforations*. The recess causes the materials to be presented to the round perforations in an upended position. Narrow pieces pass through and wider pieces pass over for discharge at the end of the cylinder.



CARTER SEPARATORS ASSURE POSITIVE LENGTH SEPARATION

Carter Disc Separators contain a series of discs mounted on a revolving horizontal shaft. Each disc has hundreds of undercut pockets which select or reject plastics or similar materials according to *length*. As the discs revolve through a mixture of materials, the pockets lift out the shorter pieces. The longer pieces, too long to be held in the pockets as they rise, drop away from the discs.

Write today for complete information and descriptive folders on Simon-Carter machines.

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Transparent acrylic working model of valve, left, was used to check new valve design before steel model, right, was manufactured. The transparent model permits easy location of possible design flaws before production models are made. (Photos, Rohm & Haas)

Acrylic valve solves filling problem

A problem of air entrapment in valves of filling machinery was solved by Hope Machine Co., Philadelphia, Pa., by using clear acrylic (Plexiglas, Rohm & Haas) to make transparent duplicates of the valves for study.

The original valves were two-way stainless steel units which admitted objects to be packaged into a measuring type piston filler. On the second part of the cycle, the material passed from the piston back through the repositioned valve to the delivery spout. Entrapped air in these metal valves rendered the filling operation inaccurate on a volume basis, and caused a shortage of product discharge in the containers, thereby impairing its salability.

Changes in the metal valves could not solve the problem, so a new approach was tried. Full-size acrylic valves and piston fillers were constructed, and put into operation for study. The transparent valves immediately revealed the point of entry of the air bubbles, and the stage of the cycle at which they appeared. The acrylic valves were then redesigned to eliminate the air entrapment. From this step, it was simple to build metal valves that duplicated the functioning of the plastics prototypes.

Now, whenever a new size or kind of filling valve is to be made, Hope engineers first make an acrylic model from the blueprints and study it before production units of metal are fabricated, saving rejection of expensive molds and preventing waste of labor and materials. Acrylic valve replicas are also used for promotional purposes.—END

Valve is checked in new package filling machine

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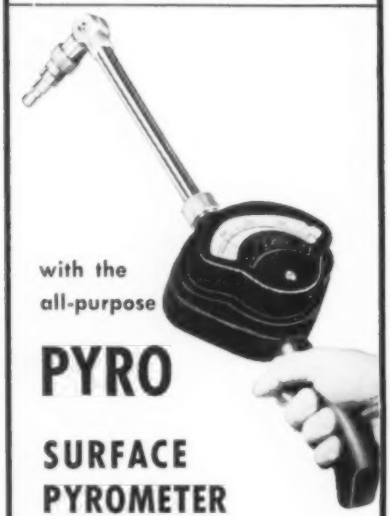

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BERGENFIELD 9, NEW JERSEY

Car top tent

A large vinyl-coated nylon fabric camper's tent (13 by 8 ft. by 8 ft. high) packs easily into a small metal carrying case which rides atop almost any automobile. The unit, called Sky Camp and manufactured by Sky Camp, Inc., South Gate, Calif., can be pulled from the top of the car and set up in about five minutes.

The designer of the tent chose vinyl-coated nylon fabric because it is light in weight, impervious to water, and can take a lot of punishment. The material —U. S. Rubber's Fiberthin is also rot- and mildew-proof.

The aluminum carrying case for the tent rides 10 in. above the car on a special rack. To set up housekeeping, the camper pulls the case sidewards and down; it rolls off on tracks and stands upright on the ground to serve as one side of the tent.

Then the camper opens a door to uncover the vinyl-clad nylon tent with telescoped supports, four folding cots with sleeping bags, and a counter which serves as the dining table. The outfit also includes a sink and stove.

When it is set up, the tent has a floor of vinyl-coated nylon and a door that can be zipped closed, as well as two large screened windows with zipper flaps.—END

Portable home, this large tent made of vinyl-coated nylon fabric packs into a small carrying case that rides atop the car. The tent, which is lightweight, waterproof, and durable, is set up on telescoping poles. (Photo, U. S. Rubber)

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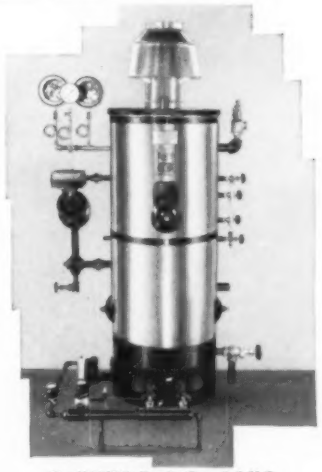

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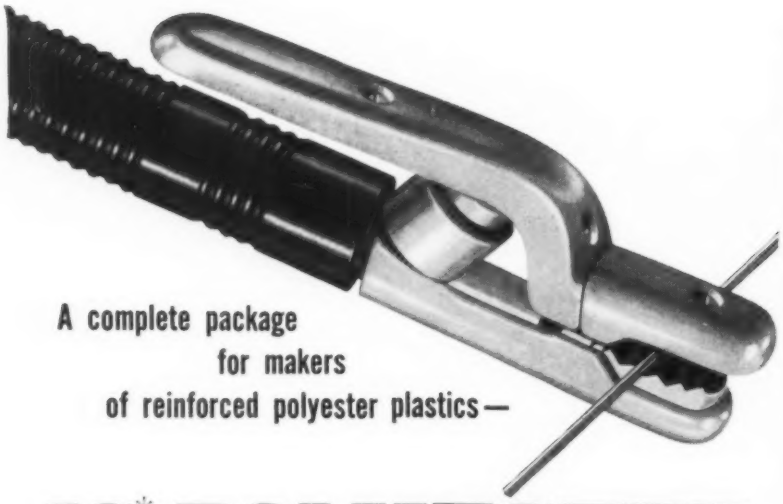

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Polyethylene

(*From pp.* 83-87)

ordinary molding, but 6.0 is used for thin-wall molding where flow is a major consideration. Until recently, 5.0 MI was the highest among high-density resins and some producers still insist that an MI as high as 5.0 is impractical in high-density molding resins; they say its use results in a flabby or "gutless" material, but there is no unanimity of opinion on this subject.

Molecular weight distribution

To a chemist, molecular weight distribution is most important in determining physical properties. One high-pressure producer explains molecular weight distribution by using a comparison with rocks. Thus, if one rock weighs 50 lb. and another 2 lb., the average weight is 26. But if the two rocks weigh 22 and 30 lb. each, the average is also 26. The latter represents a narrow molecular weight distribution. This same producer uses a narrow molecular weight distribution for 0.915 to 0.925 density material and melt indices all the way from 0.3 to 22.0 because this combination gives better stress-crack resistance. But his 0.929 density resin has a broad molecular weight distribution with a 5.0 melt index to give high clarity, low blocking, and stiffness to a 0.35-mil film for garment bags. He thus uses narrow molecular weight distribution to enhance certain properties and broad molecular weight distribution to enhance others; but in each case he must sacrifice certain properties to gain others.

On the other hand, another high-pressure producer has a broad molecular weight distribution in his resins and sells to most of the same markets as his competitor. But he will vary the density and melt index and the customer will probably run the material with different controls than he would that of the other producer. An explanation of these variables seems confusing to the layman, but the technicians who operate machines are learning to distinguish between them; the more alert ones are

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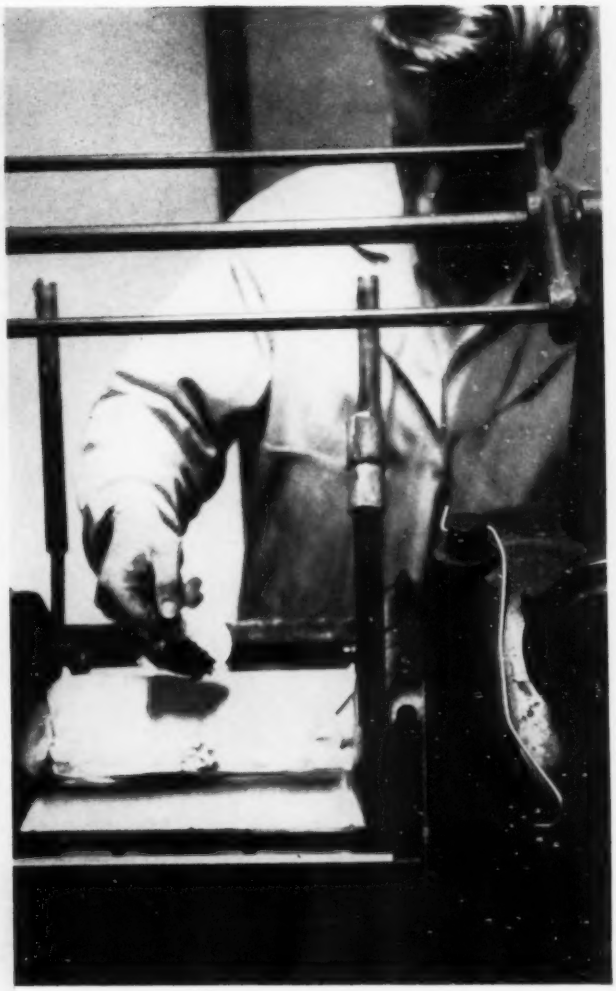

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demanding a specific resin with a certain density or melt index, depending on whether they want it for garbage cans, refrigerator bowls, nursing bottles, or whatever.

Molecular weight is still another term used in connection with all these variations, but it is something for the chemists rather than the layman to discuss. Generally speaking, a high molecular weight means that the material can be tougher and somewhat more difficult to work. A low MI means that the resin tends to have a high molecular weight. Molecular weight has nothing to do with density. For example, Allied's AC-6, which is used as a blending material to give increased flow to other resins, is a very low molecular weight material, but its density is around 0.935.

With these general over-all variations in mind, it will now be easier to explain resin differences more specifically as they pertain to particular end-use groups.

Molding material

Molding resins of conventional type polyethylene are now used in a density range of around 0.915 to 0.930—mostly in the 0.915 to 0.925 area. For housewares and toys, the idea is to use as low a density as possible and still maintain enough stiffness to prevent flabbiness. The tendency is to use a resin with a density of around 0.915 and an MI that may go as high as 25.0—a combination that gives fast flow and flexibility. These are called "less critical" applications and danger of stress cracking is not particularly important.

But if the application demands more stiffness, the molder may use a higher density in the range of 0.920 to 0.925. If he wants high flow, short molding cycle, and good gloss, he will use a melt index of perhaps 20.0. If he wants stiffness and resistance to stress crack, he will use a low melt index in the neighborhood of 2.0. Stiffness increases somewhat as melt index goes down, but to a much greater extent as density goes up. *Again and again it must be emphasized that if one particular property is most desired,*

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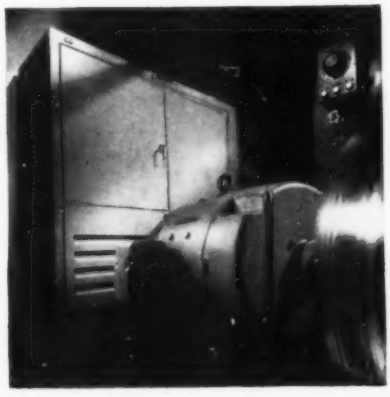

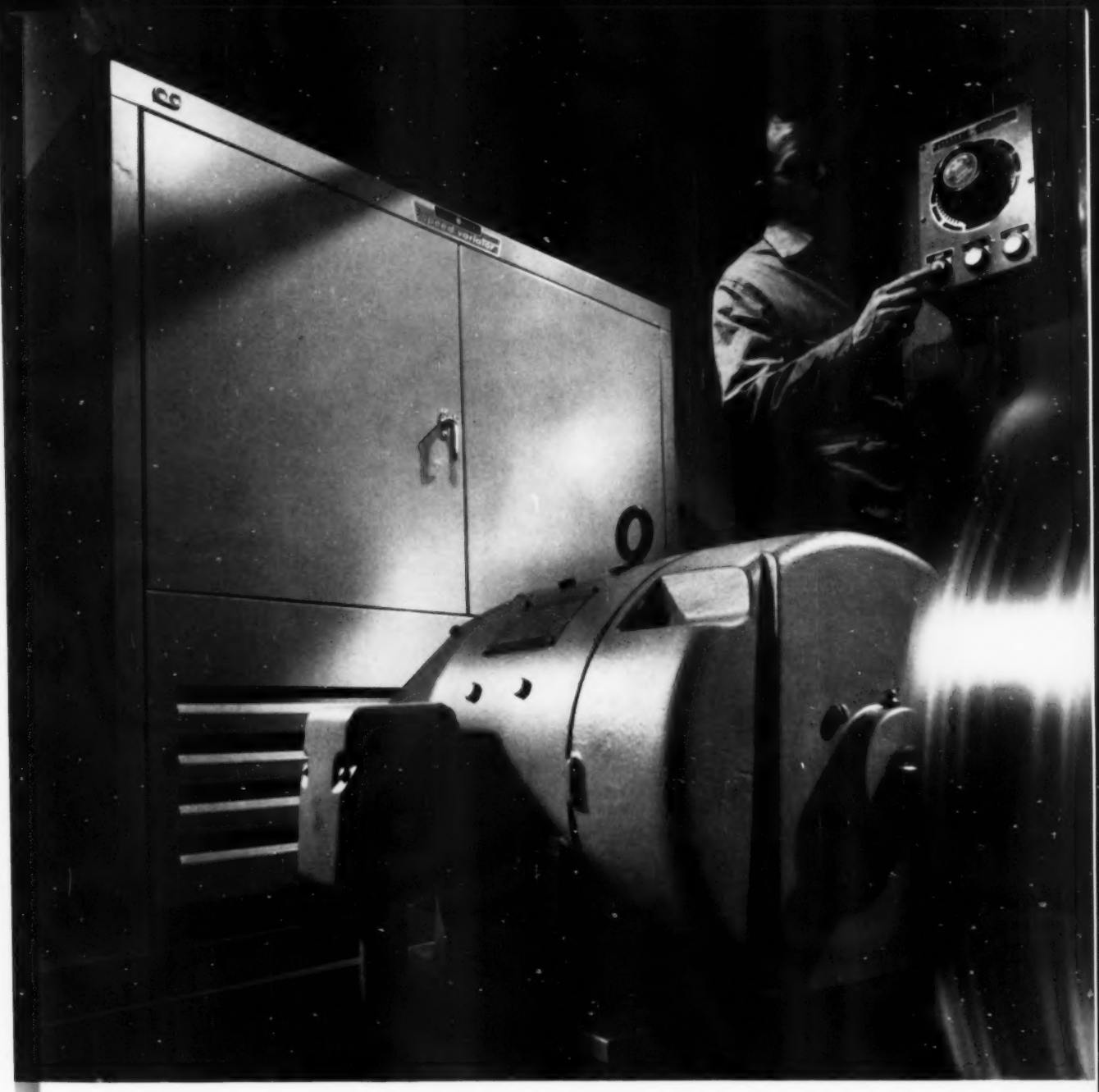

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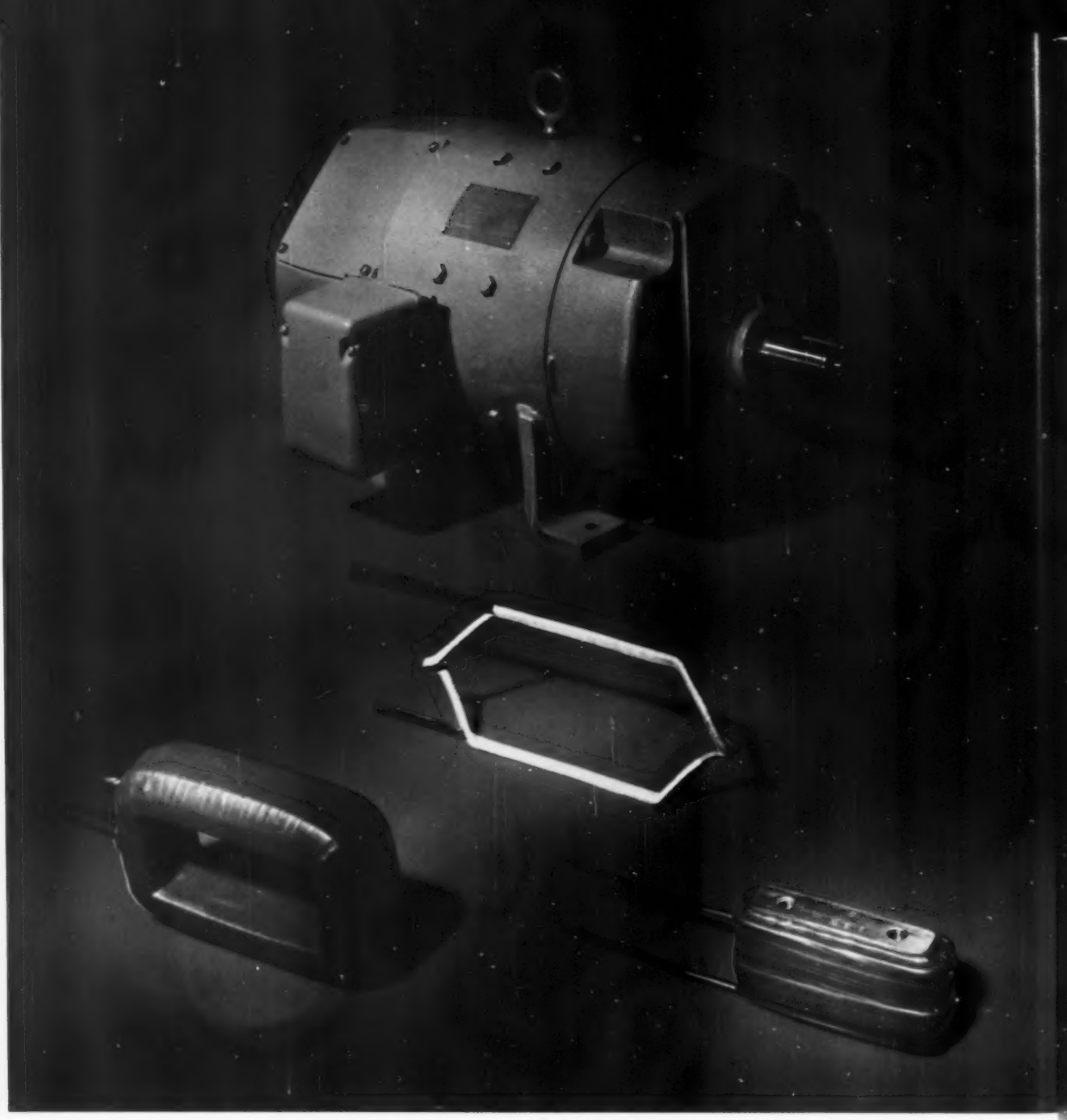

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some other property must be sacrificed.

The low-density resins mentioned above are quoted at 35¢/pound. If the molder needs upgraded properties, such as more heat and abrasion resistance with increased rigidity, he may go to medium-density resins in the 0.930 to 0.935 class, with an MI of around 12.0 if he wants high flow and a short cycle—or as low as 1.0 MI if he wants to maintain certain properties at their optimum value. But for these resins he will pay from 37 to 42 cents. It should be noted again that many properties, except for toughness, stress crack resistance, and low temperature brittleness generally go up as density increases and that processability, in turn, eases as the melt index increases.

No single ideal material

An ideal polyethylene would be one that is tough; clear; flexible but stiff enough to have good body; impermeable; resistant to heat, abrasion, oxidation, and chemicals; and easy to process. But no such polyethylene exists and, consequently, compromise is necessary in order to obtain the best combination for the job to be done.

Molders find methods to meet this so-called "ideal" state by all sorts of stratagems. A garbage can manufacturer, for example, must find a resin that will give good body without stress cracking. If he uses too stiff a resin, it may not be tough enough to stand abuse at winter temperatures; if he goes to the other extreme, the material will be too weak and flabby. But he must have a resin that flows easily, so he is compelled to use one with a high MI, even though he may thereby lose a bit of toughness. And now-a-days he feels it is dangerous to use a higher priced resin for fear his competitor is cutting corners. And even though the competing garbage can may fail in service, it won't help the first molder because he has lost a customer who couldn't tell a good can from a bad can by sight. It is likely that no two molders of garbage cans in the country are using the same den-

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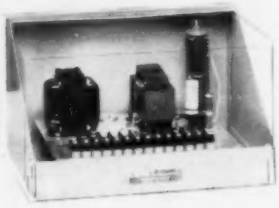

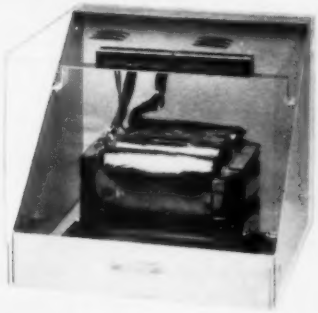

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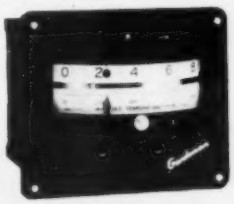

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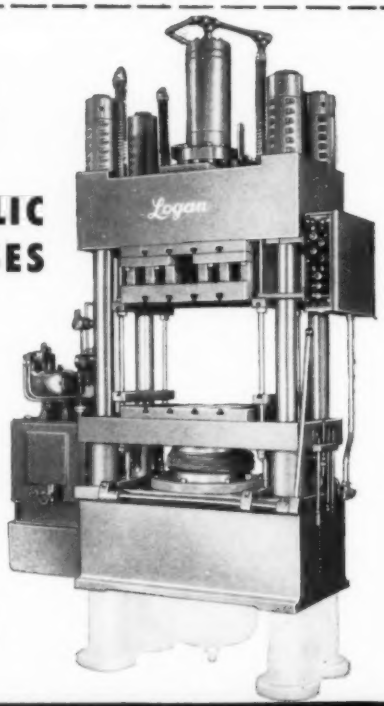

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sity resin or the same MI. It would be foolish to guess, because they may change tomorrow; but each one is doubtless trying to improve on what he has from a cost and quality viewpoint. At least one new development in the field is a can lid molded from linear, high-density material with an MI of 1.0 or 2.0, which is necessary to obtain more rigidity.

One producer states that his narrow molecular weight distribution resin at a density of 0.915 with an MI of 22.0 has been used in molding a garbage can at 5 lb. per shot. In a practical test at −22° F., his material stood up while others of the same density and MI failed. He naturally uses this example as a boost for his company's method of production which favors narrow molecular weight distribution, but readily admits that a resin with broad molecular weight distribution would, of course, have certain advantages over his resin in other applications.

In all large moldings, there is an effort to obtain body or stiffness with a low-density, high MI resin. Sometimes it is accomplished by redesigning the mold. Waste baskets and dishpans, for example, are made with an extra thick rim around the top to give the feel of stiffness, while the walls may be comparatively limp yet capable of withstanding considerable abuse

Blending sometimes helps

Blending of various sorts is also employed by molders. For this purpose, very many are using a low molecular weight 30¢ material of a type not ordinarily used by itself for molding. This is blended in quantities of from 10 to 20% in resins of 0.920 density and under that have a low MI. The idea is to preserve stress-crack qualities and improve flow characteristics since the very low molecular weight resin has extremely good viscosity and is claimed to act as a plasticizer that makes the formulation mold easier.

There are also great quantities of blended materials in the hands of reprocessors. A large portion of their foundation stock

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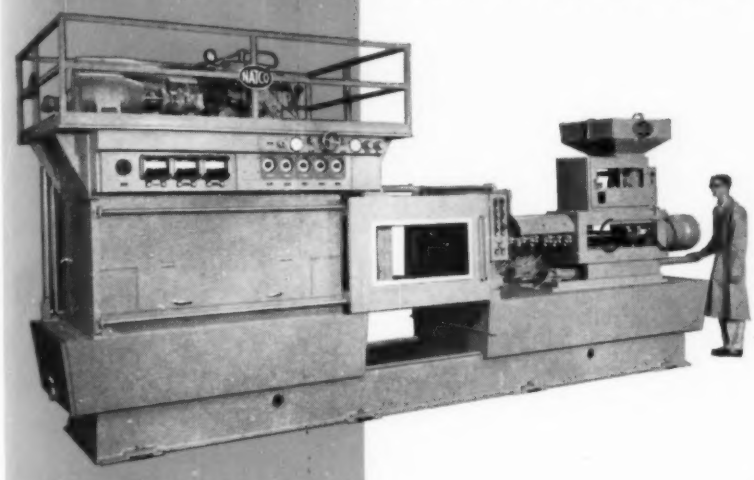

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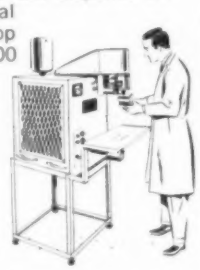

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comes from off-grade polyethylene, of which there will always be a goodly supply because it is virtually impossible to make polyethylene without producing some off-grade material. Today there seems to be a good market for such material among both reprocessors and molders. Before use, it is generally compounded with virgin material, carbon black, colored pigment, and sometimes even with scrap.

The easy availability of all these varieties of material has led to considerable price scrambling in the industry and much of the talk about price instability has derived from this situation. However, there are indications that this off-grade price scramble is beginning to form an orderly pattern. So far as can be ascertained, the schedule is about like this: good color and good color uniformity, 31½¢; uniform material slightly off-color, 29½¢; "ununiform" mixture of white and off-color, which normally must be colored, 28½¢; off-grade that must be compounded with black, 22 cents.

A great portion of all of this material, with two exceptions, goes for housewares and toys. Some of it is upgraded with linear, high-density polyethylene. A sizable quantity of the lowest grade is upgraded and sold by reprocessors at around 30¢/lb. for mine pipe. Some 10 or 15 million lb. is exported. The total of all this off-grade material is estimated to be from 65 to 85 million pounds.

In addition to off-grade material, great mountains of scrap are likely to accumulate in the future. Film scrap and banana bags are already a big source. If heavy 20-mil bags for fertilizer and other materials come into common usage, there will be millions of pounds more. When these things get all mixed up, the problem of melt index and density will be more complicated than ever.

High density for molding

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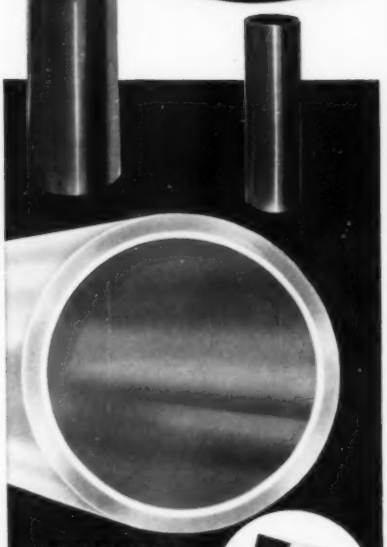

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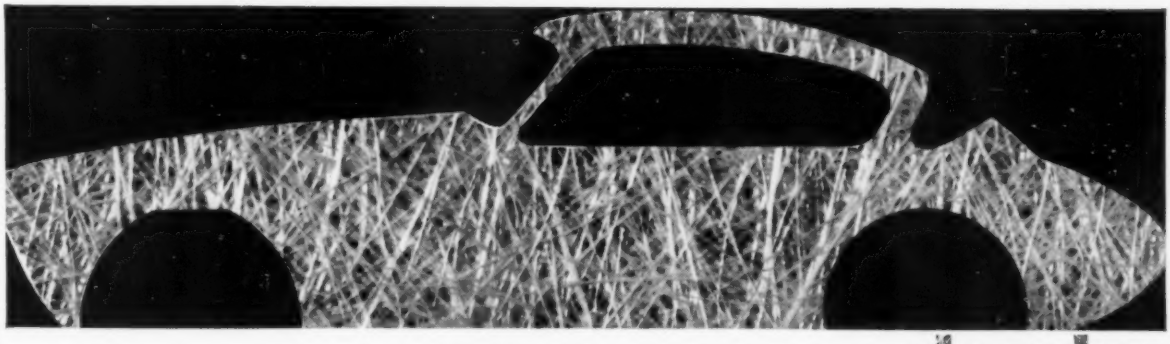

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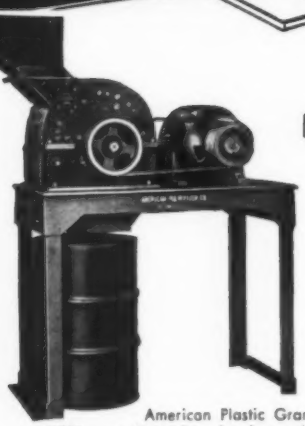

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its acceptance, but producers claim that cost can be at least partially overcome by molding thinner walls, since high density material is stiff. Molders have also found that they have to build new molds or redesign their old ones for resins over 0.940 density. The new molds must be designed for thinner walls, a different shrinkage ratio than other thermoplastics, a different rate of cooling, and cavities that will fill quickly.

However, experimentation has shown that old polystyrene molds can often be used by simply changing location of the cooling coils. One such mold is now turning out a tumbler in linear polyethylene faster than it ever did in polystyrene. The molder also found that he needed higher pressure rather than heat than he had used with polystyrene.

Until mid-summer 1958 there were no linear polyethylenes with an MI over 5.0 and some producers claimed that an MI over 5.0 for linear polyethylene did not aid processing to a marked degree and was likely to result in weak walls. But now Koppers and Bakelite have resins that have an MI of 6.0 or 9.0 which are suggested for molding where flow is a major consideration.

Generally speaking, the pattern of swapping properties by choosing the right MI is the same in high-density as low-density material, but the melt indices suggested by different producers for a given application may vary to a considerable degree. Thus, one producer suggests a 1.5 MI for industrial moldings where properties are critical, such as insulators and valves, and another company suggests 0.9. One suggests a 3.0 MI for general moldings such as housewares and another suggests 1.5 but goes up to 3.5 for a deep draw like that in a juice mixer. These are largely the differences between Ziegler and Phillips type resins. The latter also suggests that a garbage can of linear material could well be molded with a 0.960 density resin and 5.0 MI, but the cover would be better in a resin of 0.9 or 1.5 MI. *There is the same pattern again—an easier flowing material for the deep draw and*

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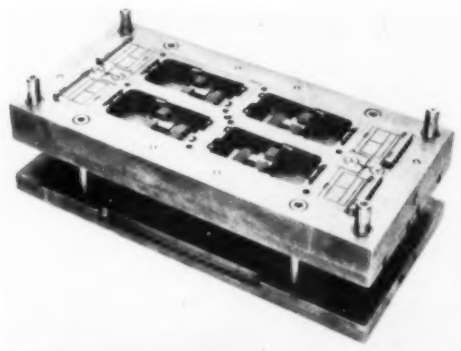

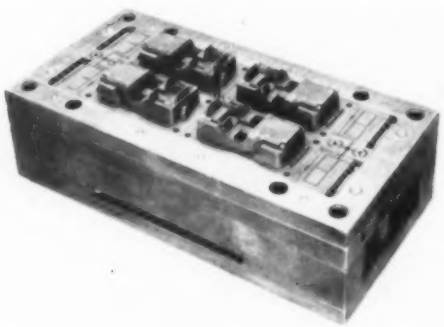

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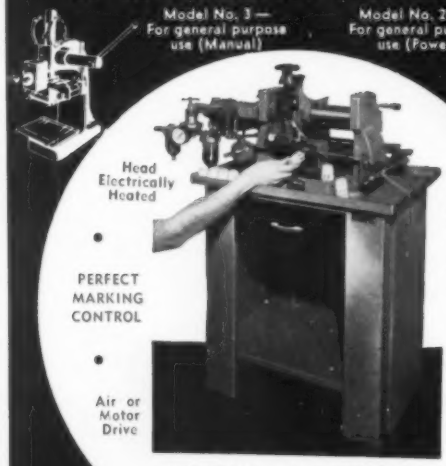

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a tougher material for the shallow, more rigid part.

Producers of resins in the 0.945 to 0.960 density range object to saying that their resins are more difficult to mold than conventional polyethylene but do admit that more strict temperature and pressure controls are needed. Also, some molders claim that high-density resins are more subject to stress cracking than low-density, but at least one Ziegler producer says that his resin has a higher molecular weight than the Phillips type and is not subject to such criticism, and Phillips has recently brought out a new series which will reportedly correct this situation.

In general, a high-density resin will be stiffer, will give a harder, more glossy surface and much higher heat resistance, and is less permeable than conventional resin. But it costs more and must be handled differently in the mold.

A completely new and rather startling development along this line is Allied's new 0.950 density, high molecular weight resin which is now being shipped in limited quantities. Despite the fact that it is a high-density polyethylene, this material is available with an MI of 15.0 which, as noted before, is much higher than any MI ever associated with high-density polyethylene. Allied is now shipping materials with melt indices of 5.0, 10.0, and 15.0. The 15.0 MI polymer flows with the ease of conventional-type molding grade low-density polyethylene, possesses good stress-crack resistance and high rigidity, and exhibits exceptional resistance to cracking at low temperatures.

There is not yet enough experience in the field to show clearly how much of the molding market will go to high-density resins, but it should eventually be at least 25 percent. It may turn out that more high density will be used in blends than is used separately, for in this way a molder may get a combination of properties more suitable for his need.

The bottle picture

Squeeze bottles are probably the most highly advertised product of the polyethylene industry,

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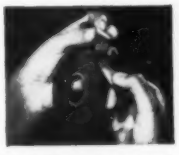

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Styron 475 was chosen for its high impact strength and complete resistance to rust or corrosion. The case is rigid enough to protect the rod, yet sufficiently resilient to prevent dents or breakage common to previously used materials. Four raised ribs run the length of the case for added strength, and end caps are octagonal in shape to keep the rod from rolling. Threaded end cap and ribs are in color for attractiveness and sales appeal. The molded end cap contains several ventilation holes to prevent condensation inside the case. The light weight of the plastic cuts shipping costs and adds to the case's convenience. The extrusion method simplifies production of the case in a variety of lengths.

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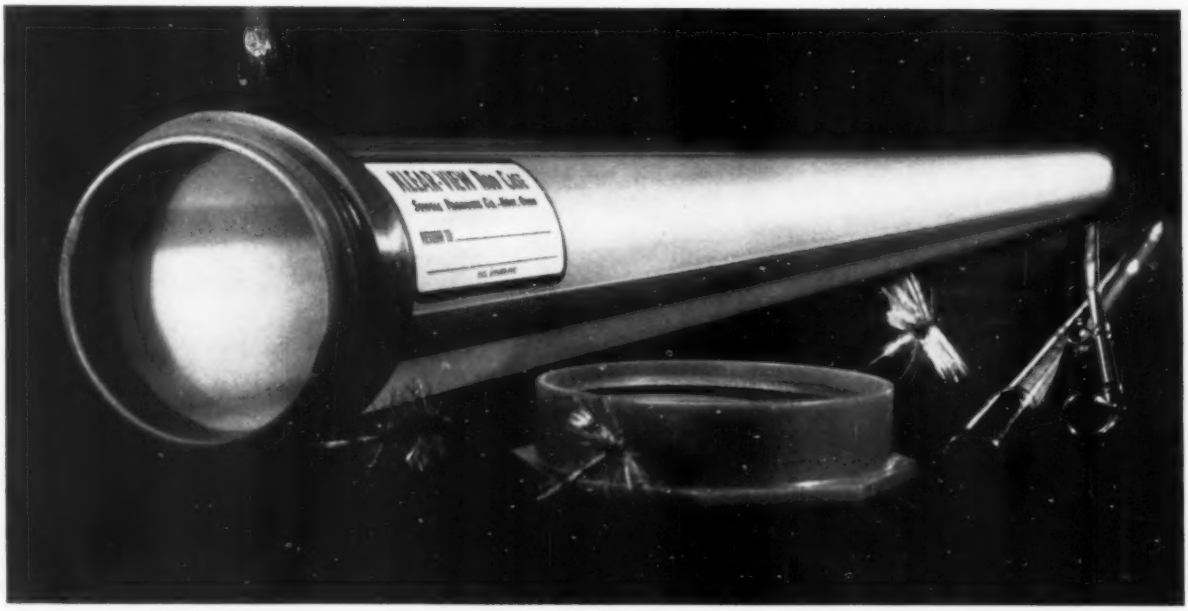

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even though volume is comparatively small compared with other end use categories.

The density of conventional resin used in squeeze bottles may vary from around 0.918 to 0.921, depending upon the supplier. The most generally used has a density of 0.919 and an MI of 1.0 or 1.5. The original experimental bottle material had an MI of 2.0, but the lower MI was adopted because it gave better stress crack resistance. If the molder wants less permeability, which is often a most important property, he may go as high in density as 0.930. In the latter case, he can use a thinner wall, but he must beware of stress cracking in this medium-density resin. But the density that the molder employs will be dependent, to some extent, on what the bottle is to be used for, because certain oils and chemicals will create stress cracks.

Nursing bottles created quite a stir in the industry several years ago. They were made of resins under 0.920 density with a low MI and could withstand a rolling boil; that is, they wouldn't distort in a short hot water treatment unless touched. Since then the density has been increased to obtain greater heat resistance. At the present time, these bottles can be molded from high-density linear polyethylene and sterilized in an autoclave.

Bottles and jars are one of the principal markets sought by the high-density resin producers. Some of them have a goal of 150 million lb. in 1960 and up to a billion or more in 1965 for bottles and jars. The articles expected to be marketed in polyethylene bottles include cosmetic creams, shampoos, mayonnaise, sauces, detergents, bleaches, solids such as salt, perhaps milk—and, of course, there is the already established nursing bottle market.

Ziegler producers generally suggest an 0.2 MI material for bottles and jars. This is a resin similar to that used for some types of wire coating. Phillips producers suggest an 0.9 MI for nursing bottles or bleaching compounds because of heat resistance and rigidity, and the new X-18 resin

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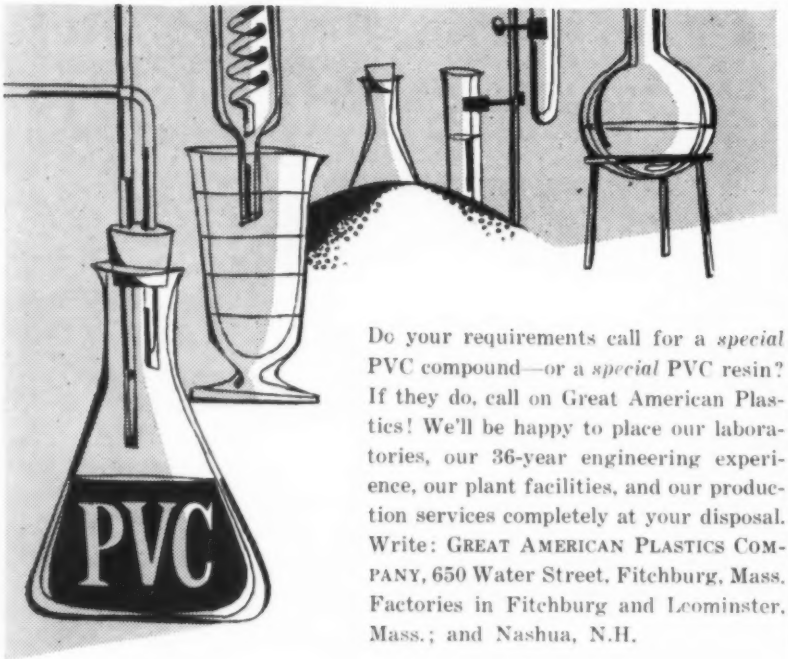

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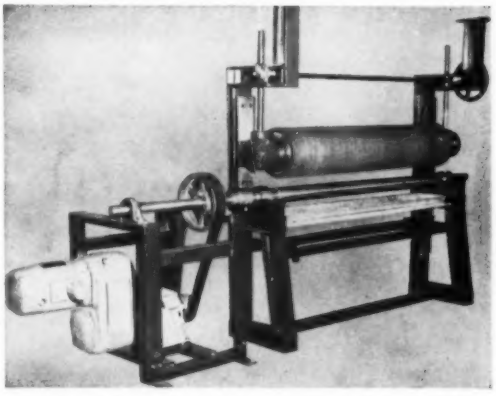

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with a higher molecular weight for detergents which might cause stress cracking in their older resins.

Apparently the high-density resins have many advantages for bottle users. They may not take over much of the squeeze bottle market from conventional polyethylene since "squeeze" means flexibility, but they will certainly invade the rigid bottle and container field. Apparently they can be produced on bottle-making machinery for conventional polyethylene by modifying the extrusion mandrel, and wall thickness can be reduced by 25 percent. It is also claimed that the production cycle can be reduced 20% over conventional polyethylene, because linear polyethylene sets up faster.

Higher density—lower permeability

And perhaps the most vital factor of all is that linear polyethylene is ⅛ to ⅙ less permeable than conventional polyethylene to most products. Complete impermeability is still not obtainable, but it is being approached. Transmission of vapor and gas seems to decrease as density goes up, but the rate of improvement slows up slightly after about 0.930 density. Nylon at 1.3 density is practically impermeable, but no one has yet or is likely to produce a commercially usable polyethylene at a density of 1.

A typical example of the variation in resins is a new detergent bottle which, if made from the older Phillips type high-density polyethylene, is subject to stress cracking caused by chemicals in the detergent. A Ziegler type polyethylene can be used to ameliorate the stress cracking because of its higher molecular weight but a thicker wall is needed for the bottle in this latter case in order to maintain the required stiffness.

• • •

Part II of this article, which will appear in the December issue of *Modern Plastics*, will deal with the general theme of how film, pipe, and wire coating can profit by the latest developments in polyethylene production and processing.

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In addition to polyethylene, Nacromer can also be incorporated into polystyrene, vinyl, acrylics, and other thermoplastics to create unusual surface effects. It can also be used as a surface coating on any plastic.

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(*From pp. 109-111*)

trusion. The greater part of the extruded film is clear transparent, and is sold for farm use.

Calendering. Except for the lack of large, high-speed calenders, this industry differs very little from that in the U. S., and shares many of the same problems. Certain markets are lacking in Japan—for example, draperies and shower curtains are not used in the Japanese home. To compensate, there are other outlets, such as the ubiquitous *furoshiki* or square carrying-cloth which everyone uses in place of a shopping bag, or even as a brief case.

By far the largest single use of vinyl film is in agriculture. In the winter of 1957-58, farmers purchased more than 50 million sq. yd. of 0.002, 0.003 and 0.004 in. film for use as seed bed covers, row-crop covers, silage covers, and crop fumigation covers, and for the construction of semi-permanent greenhouses. Polyethylene film is also entering this market, and may account for an additional 15 to 20 million sq. yards.

High-cost plasticizers have inhibited the export of film and film products from Japan, but with market prices of both resin and plasticizers now in a downward trend, the ability to compete should be sharpened.

A number of calenders are operated exclusively for the production of unplasticized rigid PVC sheet. When thick plates are required, they are produced by laminating calendered sheets in multi-platen hot presses. Sheet and plate uses include fabricated industrial plant equipment such as ducts, hoods, tank linings, gutters, corrugated glazing, and siding and as interior paneling in railroad passenger cars and busses. Vacuum forming techniques are used to produce signs, displays, refrigerator parts, etc.

Compression molding. This field is one of marked contrasts: a few very large molding plants, mainly departmental operations of big electrical firms; and more than 1000 very small shops, mostly equipped with gas-heated hand-power presses. Of the approximately 10,000 metric tons of phenolic molding material consumed in 1956, almost half went into electrical components. Urea has continued as a strong competitor for thermoplastics in electrical appliances and housewares, but the largest single use is in closures.

Machinery, tools, and dies. Rapid strides are being made in the quality and performance of Japanese molding presses and extruders. Since the domestic market is still the main target of the machinery manufacturers, certain refinements and advantages of U. S. or European equipment may be omitted in order to keep prices low, and there is little emphasis on automation.

In tools and dies, a field where Japanese craftsmanship might be expected to excel, the standard of quality is low. This is due less to poor workmanship than to the lack of improved steels. Further,

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Heating Load—Watts	1800	12,750	25,000
Heating Zones	2	4	4
Gear Ratio (Standard)	20:1	23.8:1	24.9:1
Transmission HP at 75 RPM	.45	28	37
Type Gears	Worm	Herringbone	Herringbone
Thrust Bearing Capacity Dynamic Load Rating	11,750#	215,000#	400,000#
B-10 Life at 75 rpm	4,000 hrs. at 5,000 psi 32,000 hrs. at 2,500 psi	27,000 hrs. at 10,000 psi 216,000 hrs. at 5,000 psi	25,200 hrs. at 10,000 psi 201,600 hrs. at 5,000 psi
Motor HP	.5	15 - 25	25 - 30
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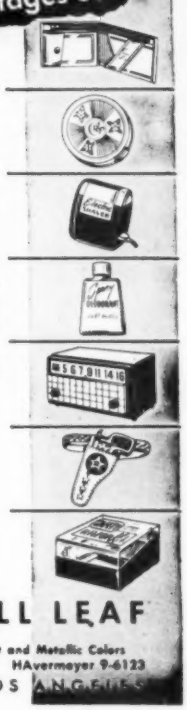

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the prevalence of short runs has blunted the edge of the problem. Another factor of considerable significance is plain lack of experience on the part of the Japanese industry, in contrast with the very extensive backlog of tooling know-how which has been accumulated in the U. S.

Is cooperation possible?

The Japanese government is currently resisting foreign capital participation in the form of validated agreements requiring the remittance of capital or dividends in dollars. The only exceptions are projects which are considered "essential" to the development of the economy. Recently, several U. S. firms have invested in Japanese manufacturing facilities on a non-validated basis.

The Japanese plastics industry badly needs expert advice on styling and packaging, quality control, and marketing methods. In return, it can be a source of products in which high labor requirements make U. S. manufacture uneconomical.

Japan should be, and may soon be, another source for good low-cost tools and dies. For this to be realized, the Japanese government will have to permit duty-free or duty-refundable import of the necessary high quality steel until such time as equivalent steels may be produced in Japan. A combination of Japanese tool and die makers has been holding discussions with U. S. interests with a view toward forming a "pool" of tool makers to work with overseas molders.

A competitive threat?

In the writer's opinion, the Japanese plastics industry by 1960 will be a vigorous competitor in some plastics raw materials, and in many finished plastics items in all overseas markets which are open to such exports. This view is based on the assumption that the development of the petrochemical industry in Japan will further reduce the cost of key raw materials; that the productivity of Japanese labor will continue to increase; and that labor rates will not change significantly in relation to the rates in effect in other industrial countries.—END

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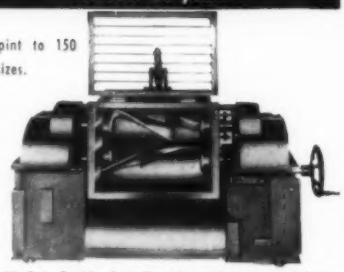

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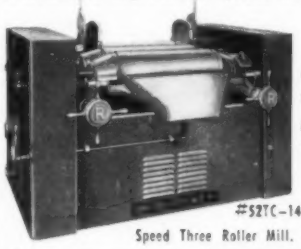

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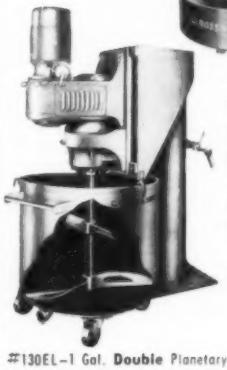

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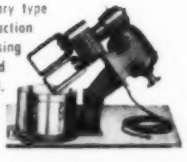

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Tarps

(*From pp.* 105-108)

A special angle in industrial tarps has been introduced by Herculite Protective Fabrics, Belleville, N. J. Herculite offers tarpaulin material in rolls 20 ft. wide (up to 100 ft. on special order) which can be cut to size on the job site. Instead of using grommets for attaching tie-lines, the slits can be cut near the edge of the fabric with an ordinary pen knife.

Because of the tear resistance of the material, these slits will not spread, according to Herculite. This method is also said to eliminate much of the usual fabrication cost for hemming and grommeting tarpaulins.

Special applications

Two specialty markets for vinyl-nylon tarps are truck and boat covers, both dominated by canvas until vinyl-covered nylon made its debut.

Plastic tarps offer truck fleet operators important savings in maintenance costs. Domestic Film Products Corp., an early pioneer of plastic truck covers, reports that one of its customers, Jack Cole Co., Birmingham, Ala., reduced tarp maintenance outlays from $600 a month to less than $100 after equipping its fleet with plastics tarps. In addition to the economies resulting from this move, reported savings of approximately $10,000 a month in wet freight claims were also realized by the company.

Looking ahead

Markets larger than any covered by the material now are waiting to be tapped. According to a spokesman for Facile Corp., Paterson, N. J., laminating firm, the greatest potential lies not in industrial tarps, but in awnings, outdoor furniture, and swimming pool covers, where special advantages over canvas are that 1) the plastic surface is easier to clean and 2) the colors are more fadeproof. Awnings are a particularly attractive market. This outlet alone could consume more material than does the whole industrial tarp field at the present time.—END

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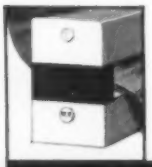

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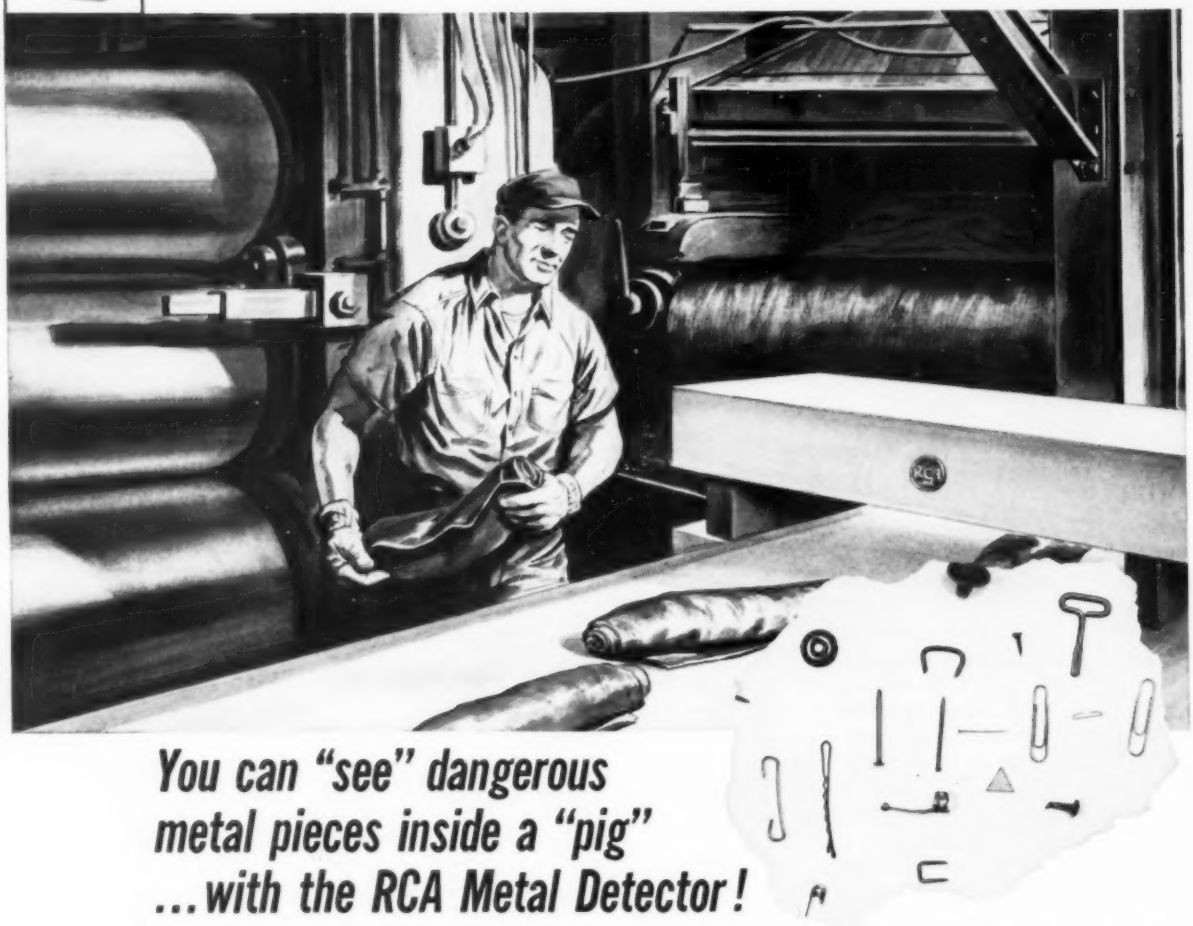

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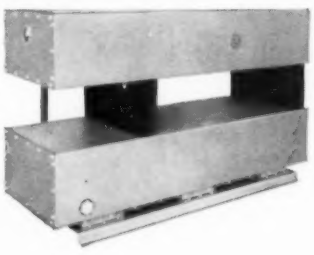

RCA ELECTRONIC METAL DETECTOR

Continuous forming

(*From pp.* 115-122)

ing only glass and kraft, with results on two commercial, all-glass mats as a basis for comparison. Conclusions are:

1) Tensile and flexural strengths of 70/30 and 60/40 glass/kraft laminates were about equal to those of all-glass laminates, but Izod impact strengths were considerably less.

2) The ratio of flexural strength to weight was higher for the composite materials.

3) The water absorption of the composites was greater.

Since kraft fibers cost about ⅓ as much as ½-in. glass fibers, these findings are rather encouraging. Addition of acetate rayon to the fiber mixture had little effect on strength properties or water absorption, but made the mat more pliable and so more easily draped, and it appeared to wet out more easily. The cured laminates also had better surfaces.

From these results, and because glass mats made by continuous slurry forming are more uniform in structure than air-formed mats, it would seem that the process will be useful in making reinforcement for low-pressure reinforced moldings, as well as for high-pressure laminates.

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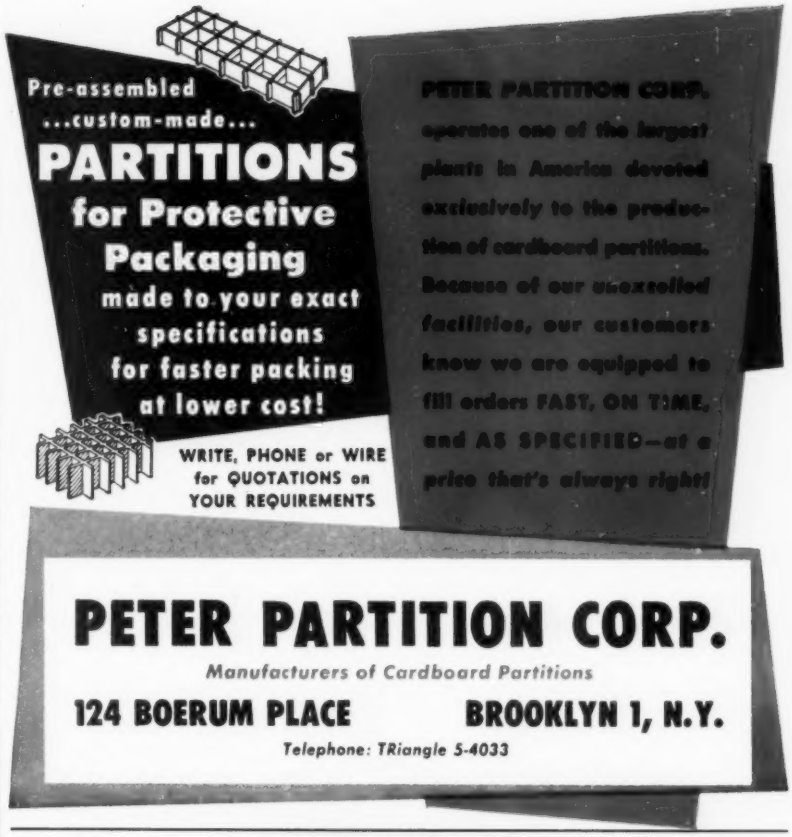
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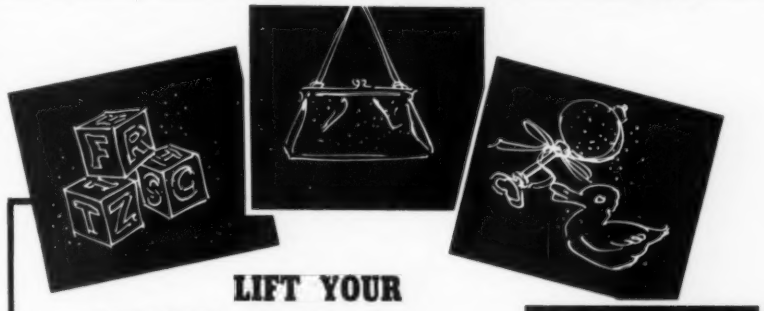

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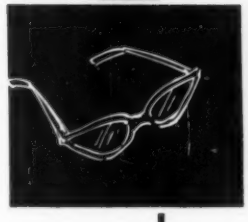

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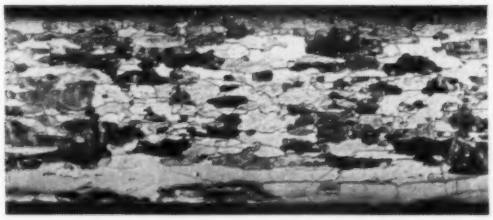

THIS IS ORDINARY TUNGSTEN. After being "shot", the internal structure recrystallizes into short grains —and invites aluminum (or other vaporizing metal) to seep in. This causes brittleness, shorter life. Now compare this with the photomicrograph of G-E "Long-Grain" Tungsten, at right.

G-E "LONG-GRAIN" TUNGSTEN. Recrystallized, it forms a protective "armor" of longer, overlapping grains that lock out the aluminum because there are fewer grain boundaries. Metallizing coils are stronger, longer lasting. Now see below what the "new twist" does for G-E "Long-Grain" Coils.

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Effect of plasticizers

(*From pp.* 135-142)

specimens can be embrittled again by annealing procedure, as in the case of more crystalline polymers. This theory, however, does not explain why the peaks in tensile strength, etc. are much more pronounced—and higher in absolute value—in the case of plasticizers with strongly polar and bulky molecules, such as TCP, DCHP, and DOP, which certainly are not likely to facilitate the crystallization process. Even in Horsley's work it is observed that the quench treatment is much less effective in compounds plasticized with TCP.

The hypothesis has been advanced by the author (3) that the anomaly in the behavior of plasticizers may be due to the steric hindrance of the plasticizer molecules which, attached with a polar group to PVC chains, could act as cross links.

Both explanations may be needed to interpret one aspect of the phenomenon. In the case of plasticizers such as DOA, DOS, and TOF, whose molecules consist of a polar group and of a non-polar, non-polarizable aliphatic group, the action may be that of facilitating the shifting and ordering of the chains into more crystalline regions. In these cases the value of the strength maximum is rather low and it occurs at very low plasticizer content. In the case of plasticizers such as TCP, TPP, and DCHP, whose molecules consist of two or more polar groups, or of a polar group and polarizable benzene ring, the formation of bulky side chains occurs, which leads to interlocking and formation of a rigid system (7). The true plasticizing action can begin only at a higher plasticizer concentration. The effect of the temperature is to increase the mobility of the molecules and is very similar, therefore, to the use of more "efficient" plasticizers.

Another demonstration of the hardening effect of small quantities of plasticizers was found in polymethyl methacrylate-dibutyl phthalate systems obtained by the process of block polymerization of a mixture of monomer and plasticizer, according to the results of A. Ferro (8). As can be seen in Fig. 14, p. 142, the maximum in tensile strength occurs at a concentration of about 4% dibutyl phthalate.

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J. M. Callihan, Sales Manager, The General Industries Company, Plastics Division, Elyria, Ohio, examines one of their plastic products.

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(*From pp.* 144-148)

I.S.O. formula for calculating pipe stresses is used. In the United States, the Barlow formula is used.

Appendix I, below, gives a method by which data can be converted from one system to the other.

From this conversion, values of permissible hoop stress can be selected to conform to any condition. Table III, p. 148, gives outside diameters and wall thicknesses of pipe calculated to have the same long-time pressure resistance as the Series 1, 2, and 3 pipe listed in the recent Department of Commerce CS197-57 Commercial Standard for Flexible Polyethylene Pipe. Up to about 2 in. nominal size in Series 2 and 3, and certainly up to about 1½ in. nominal size in Series 1, pipe made of Hi-fax high-density polyethylene is believed to be flexible inasmuch as it can be coiled over drums of diameter 5 ft. or more, and can be uncoiled from such drums without difficulty for installation purposes.

By comparison of Table III with the wall thickness shown in CS197-57 for pipe made from low-density polyethylene, it is evident that pipe made of Hi-fax high-density ethylene polymer will meet the pressure ratings that are called for in this standard, using walls that are only 55 to 60% as thick.

Acknowledgments

It is a pleasure to acknowledge the help of Dr. F. H. McTigue of the Hercules Research Center, who provided the data of Table II, and of other members of Hercules Cellulose Products Dept., who have discussed many of the ideas that have been set forth in this paper.

Appendix I

Conversion of permissible stresses from I.S.O. to Barlow system:

In the I.S.O. (International Standards Organization) system, where S_i = permissible hoop stress the following relationships are employed:

$$t = \frac{Pd_m}{2S_i} = \frac{Pd_o}{2S_i + P} = \frac{Pd_i}{2S_i - P}$$

where t = thickness; P = pressure; and d_m, d_o, and d_i = average, outside, and inside diameters, respectively, in consistent units (8). The Barlow relation used in the U. S. is

$$S_h = \frac{Pd_o}{2t}$$

where S_h = permissible hoop stress.

Hence $$2S_i + P = \frac{Pd_o}{t}$$

$$S_i = \frac{Pd_o}{2t} - \frac{P}{2}$$

$$S_i = S_h - \frac{P}{2}$$

or $$S_h = S_i + \frac{P}{2}$$

Thus, to calculate pipe stresses in Barlow terms using the data of Fig. 1, one would use, for pipe at 50 to 60° F.,

$$S_h = 710 + \frac{P}{2}$$

where P is continuous maximum working pressure in pounds per square inch.

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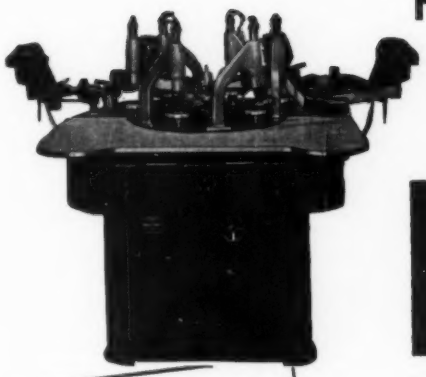

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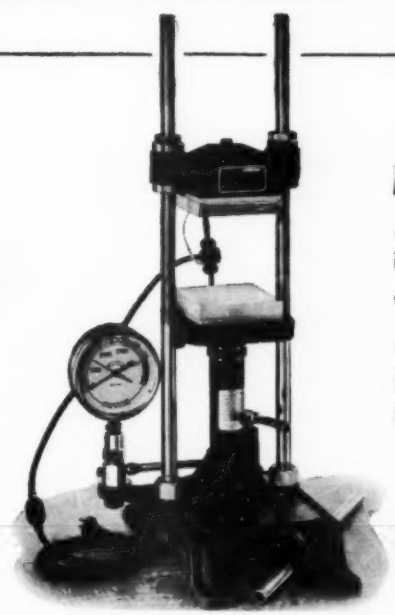

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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 41)*

Antistatic styrene

Virtually no attraction for dust particles is a specific property claimed for new "low-static" styrene injection molding materials announced recently by Monsanto Chemical Co., Springfield, Mass.

Designated "Lustrex Lo-Stat," the materials are already available in general purpose and heat-resistant general-purpose formulations; impact formulations also are being tested and samples of both medium impact and high impact products are available for evaluation by molders. Lo-Stat may be purchased in both crystal and special colors. Formulations are priced at 1¢/lb. higher than their counterparts in standard styrenes for injection moldings.

The new materials are said to practically eliminate the electrostatic fields which draw dust and arrange it in unsightly patterns on the surfaces of molded pieces. They will not escape that dust which reaches it through normal gravitational fall-out but, unlike other styrenes, they do not act like a magnet which attracts the bits of dust that would otherwise pass it by.

The affinity of styrene for dust is due to static charges acquired during the molding operation. However, because of the presence of an additive incorporated by the material maker in the Lo-Stat compounds, the molded surfaces are reported to be sufficiently conductive to allow most of the positive and negative charges to neutralize one another. This means that the forces which draw dust and make it cling in unsightly patterns are virtually eliminated. It is stated, however, that the surface conductivity is not great enough to adversely affect the electrical properties of the moldings.

In molding, the Lo-Stats can be handled like their equivalents in conventional styrenes; no special techniques are required.

The low-static styrenes are especially recommended for such applications as displays, clock housings, furniture drawers, grilles for fans and air conditioners, package closures, record player arms, and a number of other specialty products which are expected to be decorative as well as functional.

*Reg. U.S. Pat. Off.

Vinyl-impregnated wall covering

A new wall covering, possessing the durability and protection of vinyl and fabric and the colors and finish of wallpapers, has been introduced by The Birge Co., Inc., 390 Niagara St., Buffalo 5, N. Y. The new material, called Fabrique, is 100% textile fibers, vinyl impregnated, and should not be compared with laminated vinyl. It has vinyl's durability, the company points out, but it cannot separate into layers, and the non-woven characteristics provide elasticity in all directions.

The non-woven fabric was developed to Birge specifications by Wellington-Sears Co., Inc., 65 Worth St., New York 13, N. Y. Fabrique does not have warp or woof limitations, and its elasticity and balanced tensile strength permit the material to "breathe" with the walls without wrinkling or tearing.

According to Birge, laboratory tests indicate that the new wall covering is practically stainproof as far as normal household and institutional stains are concerned.

Fabrique has an embossed surface which will not disappear after wetting and hanging. Because of its weight and texture, it can be hung satisfactorily over most types of sand-finished and texture-painted walls. Special adhesives are not required.

The new line of wall covering is available in 131 combinations of 37 designs and in 10 solid tints, in rolls 21 ft. long and 20½ in. wide. The suggested retail price is $3.20 for solid tint rolls and from $3.50 to $3.85 for patterned goods, according to designs and colors.

Flame-retardant polyethylene

Commercial availability of new flame-retardant compounds of its Grex high-density polyethylene in a variety of colors has been announced by W. R. Grace & Co. Among the first applications for these compounds are television yokes, baby bottle warmers, and cylinder heads for tanks containing nitrogen, oxygen, and acetylene.

Other indicated uses are television high-voltage sockets, automobile electrical connectors, electrical sockets for general use, electrical bushings, insulators, specialized aircraft applications, and air ducts for ships. While many of the applications will be in the electrical and electronics fields because of the material's good electrical properties, it is also expected to find use in safety goggles, fire extinguisher cones, water tower cooling grilles, etc.

The first two of the new flame-retardant series of Grex high-density polyethylenes are known as C-1007—particularly suited for products requiring higher impact strength—and C-1008, a freer flowing compound for larger moldings.

Color concentrates for polyethylene

A group of eight new Tenite polyethylene standard color concentrates, introduced by Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co., is reported to offer molders an economical way to obtain thorough

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dispersion and consistent color in polyethylene products.

The new standard concentrates consist of high-concentration pigments predispersed in polyethylene-base material. Although these concentrates are designed for use generally in a 1-to-10 ratio with natural polyethylene, a wide variety of shades and colors can be obtained by varying the ratio. Also, it is possible to mix two or more concentrates of different colors, in ratios determined by experimentation, to achieve mottled color effects or other individual colors, the company states. When the proper ratios have been established, the resulting colors or effects can be reproduced consistently.

Tenite polyethylene standard color concentrates will be stocked in 10- and 50-lb. bags. A mixing ratio of 1-to-10 is easily obtained with these packages without necessity of weighing.

The eight standard color concentrates are being offered at prices ranging from 44¢/lb. for 20,000 lb. or more packed in 50-lb. multi-wall paper bags to 58¢/lb. for less than 50 lb. packed in 10-lb. polyethylene bags.

Universal grade laminate

A new grade of decorative plastic laminate, called Universal Grade Micarta, has been announced by Westinghouse Electric Corp., Pittsburgh, Pa. It replaces the postforming and non-postforming grades formerly available.

The new laminate, 0.050 in. thick, can be fabricated as easily as the standard 0.050-in. postforming grade, but will be priced the same as the lower cost non-postforming grade. According to Westinghouse, the new grade can be handled on all available types of postforming equipment.

Universal Grade Micarta is reported to meet all NEMA standards for postforming and has abrasion resistance superior to the existing standard grades. It also offers better core-hiding qualities through reduced grain transfer of core material to the surface, the company states.

Cabinet doors, sink tops, desk tops, and vanities can now be postformed at reduced cost and, in addition, the universal grade decorative laminate is said to have longer life in hard usage applications.

Paper-base laminates

Two new paper-base plastic laminates, Grade FR-1 and Grade EP-22, are being offered by Synthane Corp., Oaks, Pa.

Grade FR-1 is available in sheets and is said to have the general properties of NEMA Grade XX—a hard paper-base laminate with good mechanical properties, high dielectric strength, and resistance to moisture, which makes it well suited for many electrical applications. It is also claimed to be flame-retardant.

Grade EP-22, an alpha paper filler impregnated with epoxy resin, is reported to have excellent electrical characteristics over a wide range of humidities and temperatures and to be especially designed for printed circuit and numerous other electronic requirements. Grade EP-22 is offered at a price substantially lower than the more commonly used glass-base epoxy laminates, according to the company.

Smaller tubing

Taylor Fibre Co., Norristown, Pa., has extended the size range of its rolled laminated-plastic tubes by reducing the minimum inside diameter from 0.125 to 0.050 inch. Maximum I.D. for rolled tubing produced by Taylor is 36 inches.

The new range of small I.D. tubing was developed to meet the requirements of many applications, particularly miniaturization in the electrical and electronics fields.

At present, the sizes below 0.125 in. I.D. are furnished in Grade XX laminated plastic. This is a paper base, phenolic resin grade which has good electrical, mechanical, and physical properties.

Vinyl stabilizer

A new vinyl stabilizer, Mark LL, now being marketed by Argus Chemical Corp., 633 Court St., Brooklyn 31, N. Y., is believed by company officials to be the best liquid cadmium barium stabilizer that has ever been developed in its plant.

According to the firm's findings, Mark LL will give 25 to 30% better performance than present formulations; that is, a formulator may use 25 to 30% less than with previous stabilizers to obtain the same result or he can use the same amount as previously and expect 25 to 30% better heat and light resistance. Mark LL is particularly effective in maintaining the true tones of sensitive organic pigments, such as lithol rubine or BON reds. It is completely soluble in all plasticizers and can be added directly to the plasticizer for rapid and easy processing of the compound.

Self-extinguishing polystyrene beads

Expandable polystyrene beads with self-extinguishing characteristics have been developed and produced by The Dow Chemical Co., Midland, Mich.

Tradenamed Pelaspan 18, the new product is similar to Pelaspan 8, with self-extinguishing materials incorporated in the beads.

Dow sells Pelaspan 18 as a raw material to plastics molders, processors, and manufacturers for applications requiring self-extinguishing properties in the general molding, air conditioning, refrigeration, appliance, and panel construction fields.

Since self-extinguishing materials are incorporated into the beads by the manufacturer, molders use no additives. Therefore, the product suffers no loss of properties. Molders use steam in the process of foaming the material in place.

The self-extinguishing expandable beads are said to have ex-

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cellent insulation properties; the product requires little cutting and fitting and can weigh as little as 1 lb./cu. ft. with good K factor.

Mylar price reduction

Du Pont has reduced the price of several types of Mylar polyester film. This is the fifth consecutive price reduction since the start of commercial production four years ago, and the second during the past year.

Type A Mylar, 100 through 1000 gage, was reduced 20¢ per pound. This type has a wide variety of uses, including electrical insulation, magnetic tape, cartography and drafting materials, and protective and decorative laminations.

Type C Mylar, in 25 and 35 gages, used primarily for capacitors, was reduced 10¢/lb., as was 50-gage K-24 Mylar, a coated film for vacuum packaging.

The current reductions bring the price of Mylar in the range of $1.80 to $3.90 a pound.

Glueable polyethylene

A new process developed by Lowe Paper Co., Ridgefield, N. J., is claimed to make it possible for packagers to glue polyethylene-coated paper and boxboard with low-cost dextrin and starch adhesives. Bags and cartons can be run on standard glue-sealing machinery at high operating speeds. As a result, use of packaging materials coated with polyethylene may be significantly increased. Possible new applications for the glueable polyethylene range from bar soap wrappers to frozen food cartons.

The first commercial application of polyethylene-coated paperboard treated by the Lowe process is a folding box used for packaging personal hygiene products of Norwich Pharmacal Co., Norwich, N. Y. In this application, which requires an effective grease barrier, Du Pont's Alathon polyethylene resin is extruded onto a clay-coated board and specially treated to create a glueable surface. The box is glued along one seam. The coating of polyethylene resin, which replaces a glassine-paper laminate, provides a highly effective single-ply barrier, especially along the fold.

Possible future applications include boxes for chlorinated powdered detergents, cereals, cake mixes, and other products requiring siftproof containers where a loose inner liner is now employed.

Frozen food packaging is another major field now opened to polyethylene-coated boxboard. A frozen food carton coated with polyethylene would need no overwrap resulting in large potential savings to packagers.

Plastics combined with felt

A marriage of felt and plastics has produced a basic series of three styles of synthetic felt combinations tradenamed Plasti-Felts.

Developed by The Felters Co., 210 South St., Boston 11, Mass., the new combinations include nylon-treated all-wool felt, where each fiber is encased in a protective sheath of nylon to provide superior resistance to abrasion and extra strength without increased density. Another style uses a special polyethylene film to prevent surface fiber shedding, to provide a grease- and oil-resistant surface, and to stop air passage through the felt.

The PlastiFelt line also includes a Teflon-coated felt which offers unusual felt properties, including low friction and high heat resistance, coupled with the self-lubricating characteristics of Teflon.

Non-toxic PVC stabilizer

A new stabilizer for use in polyvinyl chloride food packaging materials is now available from Ferro Chemical Corp., Bedford, Ohio. Known as Ferro 763, it has been approved by the U. S. Food and Drug Administration. The stabilizer is offered in addition to Ferro 707X and 760X for non-toxic flexible formulations, both clear and pigmented, where long-term heat stability is the prime requirement. It is recommended by the company for calendering, extrusions, and plastisols.

Ferro 763 is a white paste compound with a specific gravity of 1.00 and a bulking value of 0.175 gal./lb. The firm recommends the product for use in concentrations of 1 to 2 parts per hundred of resin with USFDA-accepted epoxy plasticizers. According to Ferro, the new stabilizer may be used at operating temperatures of 365 to 385° F., where Ferro 707X and 760X cannot be used.

The company also announces that it has concluded a license agreement with Chemische

Factory sales of products using plastics in large quantities, first six months

Products	*1957 (In 1000 units)*	*1958 (In 1000 units)*
Floor-type vacuum cleaners	1611	1502
Television sets (retail sales)	2810	2187
Electric refrigerators	1804	1486
Radios (retail sales)	3640	2964
Washing machines	1795	1597
Automobiles	3373	2235
Trucks and buses	582	446
Private homes (started)*	579	413

*Building took a significant upswing in July, bringing the total for the first 7 months of 1958 to 635,798, compared with 611,500 for the same period in 1957.

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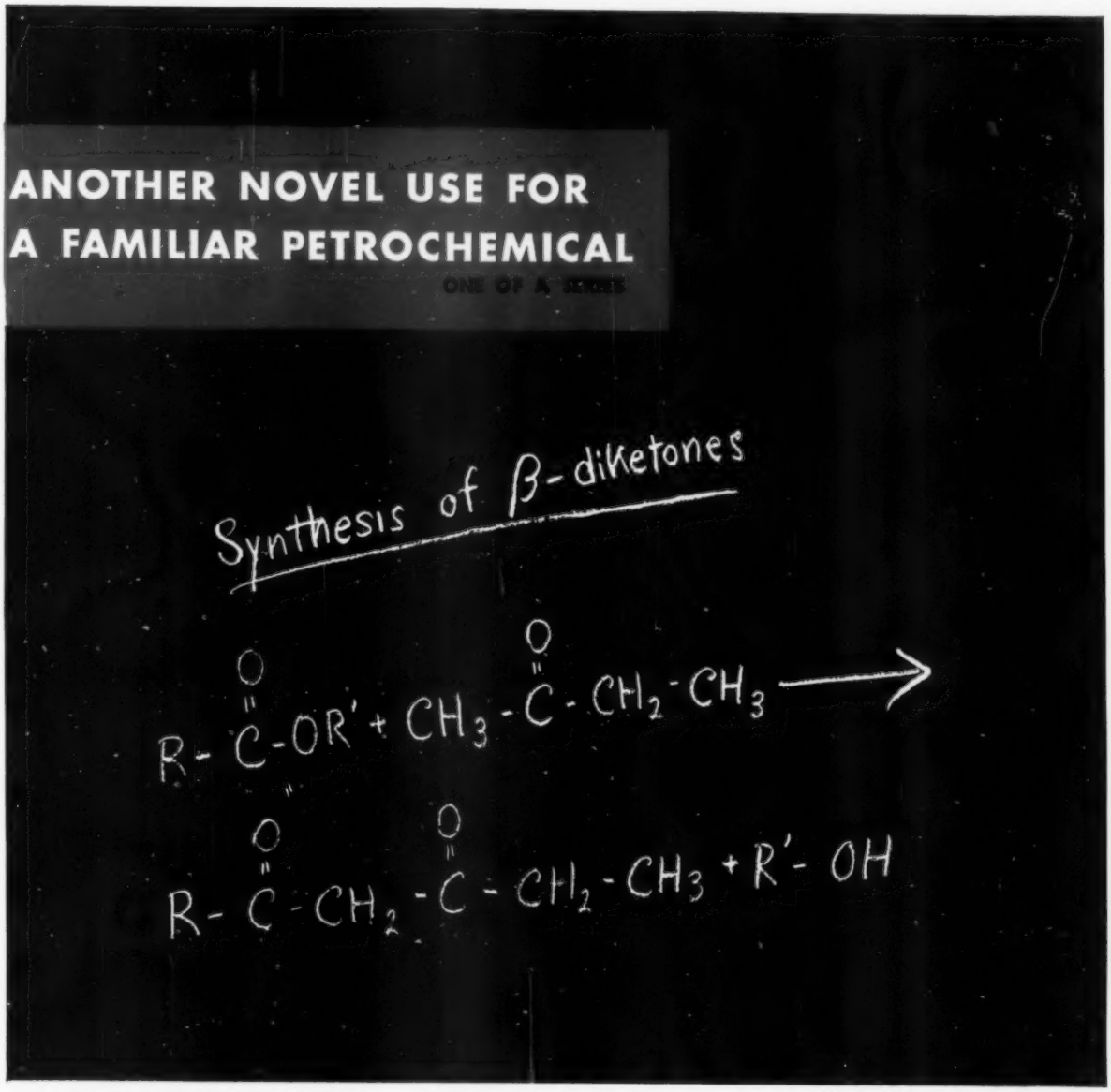

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New consulting firm

Leslie J. Kovach, a former research and development engineer and plant manager for European and U. S. plastics firms, heads the newly formed Kovach Engineering & Consulting Co., 215 A St., Boston, Mass. His company will offer plastics manufacturers a range of services on the research-development, management, production, and marketing levels. K.E.C. claims to be equipped to handle any size or type of production assignment and will work on all phases of plastics production, including injection molding, extrusion, vacuum forming, blow molding, decoration, process automation, and packaging.

License for saran bags

The Dow Chemical Co., Midland, Mich., has been authorized by The Cryovac Co., Div. of W. R. Grace & Co., to license its customers to use the Cryovac process with shrinking saran bags made by Dow.

The Cryovac process patents cover the use of shrinking plastic packaging materials which are used to produce skin-tight, vacuum sealed packages for all types of food products, particularly meats, cheese, poultry, and fish.

Mylar drawing material

Drafting materials, based on Du Pont's Mylar film instead of the traditional coated cloth or paper, are now being offered by several manufacturers.

In contrast to conventional drawing materials which become yellow, frayed, and worn, the more durable polyester film withstands wear and abuse without tearing and fraying, does not turn yellow, and lasts indefinitely, according to Du Pont. Mylar does not absorb water, oil, or grease, and soiled drawing can be cleaned readily.

Because of the film's toughness, draftsmen can make four times as many erasures as on conventional materials, it is reported. Mylar is not affected by temperatures from −80 to 300°F. and does not become brittle with age.

The materials based on Mylar are offered at about the same cost as many grades of cloth. Both pencil-and-ink and sensitized surfaces are available.

Stocks polyethylene sheet

High-density polyethylene sheets in small quantity orders are being offered from stock for immediate delivery by Midwest Plastic Products Co., 1801 Chicago Rd., Chicago Heights, Ill.

Called Midlon Lp, the polyethylene sheets are carried in sizes 40 by 72 in., in seven thicknesses from 0.020 to 0.125 inch. The material is said to have high crystallinity, high tensile strength, high softening temperature, high stability, and low permeability. Midlon Lp has a high gloss and is claimed to be nontoxic.

Inks for vinyl fabrics

Fire-resistant solvent inks for valley or inlay printing on vinyl fabrics are offered in a full range of colors, including metallics, by Claremont Pigment Dispersion Corp., 39 Powerhouse Rd., Roslyn Heights, N. Y.

Designated the VCV series, the inks are said to have an extremely high flash point and to possess excellent storage stability.

More specifications approved

The following specifications have been approved and printed: MIL-I-14511, Insulation Sheet, Cellular, Plastic; Thermal. MIL-P-14591, Plastic Film; Non-Rigid, Transparent.

The Ordnance Materials Research Office has announced that these specifications will require prior qualification testing, and manufacturers should take prompt action concerning qualification testing of the products they wish to offer for Government procurement.

Information on the submission procedure may be obtained from Commanding Officer, Picatinny Arsenal, Dover, N. J., Attention: Plastics and Adhesives Laboratory.

Distribution policy changed

Boltaron 6200 and 7200 rigid polyvinyl chloride materials, previously distributed by H. N. Hartwell & Son, Inc., Boston, Mass., are now available directly from The General Tire & Rubber Co.'s Bolta Products factory in Lawrence, Mass., according to a joint announcement by both companies.

These materials include PVC sheet, rod stock, block stock, and welding rod, used primarily for corrosion-resistant applications. However, all PVC pipe manufactured by Bolta is now being distributed by General Tire's affiliate, A. M. Byers Co., Pittsburgh, Pa.

New color speckles

A new line of color speckles for achieving special "salt-and-pepper" color effects in styrene, polyethylene, acrylic, and polyester resins is now available from the Color Div., Ferro Corp., 4150 E. 56th St., Cleveland 5, Ohio.

According to the company, the speckles may be used alone or with regular pigments in either opaque or translucent resins. Added with regular colorants, the color speckles are reported to be evenly distributed by ordinary blending and molding. It is claimed that they stay suspended during molding and will not bleed or affect plastic integrity. Permanently embedded, they cannot flake off.

The company has also developed a line of specially "purified pigments" for use in coloring fluorine resins. Composed of inorganic metallic oxides, the pigments are manufactured at temperatures higher than the 650° F.

(*To page* 227)

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

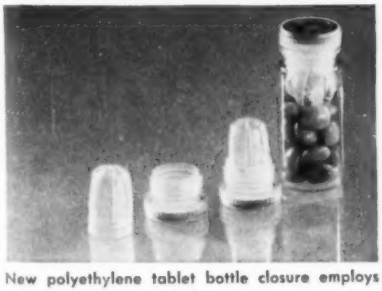
Packaging Notes

Drawstring or Poly Bag has enabled one produce packer to cut labor costs and increase packing speeds 15 per cent. The drawstring runs through a strong, heat-sealed hem on 5-lb. bags of 2 mil polyethylene film. The closure is strong enough for the string loops to be hung on overhead conveyors or used by customers as a convenient carrying handle. The bags require less film to fabricate than do tied-top bags and they are claimed to be easier to fill. Produce shippers have expressed interest in the drawstring poly bag for packing potatoes and citrus fruit.

Polyethylene Bottle Closure with expandable plug is designed to prevent movement and breakage of pills during shipping and use. The patented closure replaces the usual cotton pad or paper insert ordinarily used with tablet containers.

The polyethylene insert is constructed to double up when the cap is screwed onto a full bottle. As pills are used the insert expands to fill the void and hold the pills in place.

Aside from convenience, the expandable closure is said to be more hygienic than cotton plugs since it is never touched in use. The inserts, used for some time by leading German pharmaceutical firms, are now being introduced in this country.



New polyethylene tablet bottle closure employs flexible insert, left, which snaps into screw cap. Insert expands to hold tablets in place even when bottle is half empty.

Two New Decorative Coatings for polyethylene have been announced recently. One is a new process for vacuum-metallizing polyethylene. Brilliant coatings result, with excellent adhesion even on such items as squeeze bottles. Alcohol-proof top coats can also be applied by the same method.

What is reported to be the first adhesive for flocking polyethylene has been announced by another manufacturer. The new adhesive makes it possible to apply a velour coating to sheet or molded products. The process is expected to find application in packaging cosmetics and quality items such as silverware.

U.S.I. Announces Crystal-Clear Poly Film Produced by Cast-Film Process

Cast PETROTHENE® Film Has Top Transparency and Gloss

A crystal-clear polyethylene film, made by a conventional processing technique adapted to polyethylene film production, was introduced by U.S.I. at the 1958 National Packaging Exposition in New York. The film, made from a U.S.I. PETROTHENE resin, has a level of transparency and gloss unprecedented in polyethylene film.

The production method, called casting, employs equipment typical of the extrusion coating industry. In the process polyethylene is extruded and drawn or cast across a highly polished chrome-plated roll. This casting step greatly improves the optical characteristics of the film. This production method also reduces formation of haze-producing crystals in the matrix of the polyethylene by providing for immediate and even quenching. This further contributes to improved clarity.

Extensive research at U.S.I.'s technical service laboratory indicated that a moderately high density resin would be required to strike a balance between properties which promote clarity and those promoting strength. PETROTHENE 205—with a density of 0.924, melt index of 3.0 and PETROTHENE 239 with a density of 0.929, melt index of 5.0 were selected.

Production Costs About Equal

Although the equipment needed for making cast film is initially more expensive, production costs appear to be competitive with those for conventional extruded film. Production speed for cast film is the same or greater than for other film producing processes.

MIRROR IMAGE? No, but the excellent clarity and gloss of cast PETROTHENE film make it almost believable. It's all done with twins.

Production on laboratory-scale equipment indicates that careful control of die temperature and size of die opening is necessary to assure gauge uniformity. However, with proper operating conditions and careful choice of resin, the resulting film has adequate toughness along with its phenomenal clarity. Widespread application in the packaging industry — where clarity is often a prime consideration — is expected.

Nitrogen Blanketing Aids Polyethylene Processing

Nitrogen blanketing of polyethylene extruder feed helps overcome gels, fish-eyes, dark spots and other problems caused by polyethylene oxidation.

The procedure was developed at U.S.I.'s technical service laboratory at Tuscola, Ill. It is based on the idea of excluding oxygen by maintaining an inert gas blanket over the resin entering and inside the machine.

According to Ralph Knight, Manager of U.S.I.'s PETROTHENE Technical Service Department, as a further refinement, inert gas also can be used to blanket the molten polyethylene as it leaves the extruder in order to reduce build-up of oxidized material on the die lips of the extruder. The same principle is applicable to other polyethylene processing methods, such as molding.

Coffee Plants Grown in Black Poly Bags

A promising new use for black polyethylene film is reported from Central America. Black poly bags filled with fertilized soil are being used to grow coffee plants in Guatemala. The film acts as a combination flower pot and mulch.

According to the report, when plants are grown in polyethylene bags, they can be brought to transplanting size in nine months instead of the 18 months formerly required. In 1957, approximately seven million polyethylene bags were used in Guatemala.

IN THIS ISSUE:

P. 2 — Cast PETROTHENE Polyethylene

P. 3 — How Resin Density Affects Film Properties

P. 4 — Guide to PETROTHENE Resins

1.5-mil cast polyethylene film made from PETROTHENE 239-27 resin has unprecedented clarity and gloss.

CAST PETROTHENE®
POLYETHYLENE

IT'S NEW!
IT'S CRYSTAL CLEAR!
IT'S INEXPENSIVE!

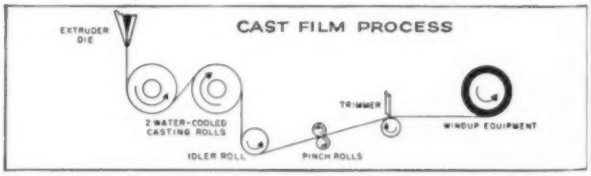
CAST POLYETHYLENE FILM
NOW OUTDATES OTHER TRANSPARENT PACKAGING MATERIALS

Cast polyethylene film—made by a special process employing U.S.I. PETROTHENE® resins—enables you to offer your customers the traditional strength and economy of polyethylene—plus sparkling clarity and gloss. Here's why cast film far surpasses other overwrap materials:

CRYSTAL CLARITY—The new process for making cast polyethylene film produces material with a clarity equal or superior to conventional transparent films. Compare a piece of cast film with ordinary polyethylene film and with transparent films now used for overwrap.

SUPERIOR PACKAGING PROPERTIES—Cast polyethylene film has good impact and tear strength, high grease resistance and is an excellent moisture barrier. It heat seals well and is easily printed. The film doesn't crackle; it has a soft, natural flexibility that adds a look of quality to packaged goods. And handles well in overwrap machinery designed for conventional polyethylene film.

ECONOMY—You can offer your customers substantial savings with cast polyethylene film. It costs less than conventional transparent materials—whether you figure costs per pound or per unit area of film. It is the most inexpensive transparent overwrap material your customers can buy.



To extruders interested in manufacturing cast polyethylene film, U.S.I. will be glad to furnish technical assistance. Contact your nearest U.S.I. office, or write:

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

U.S.I.

Vol. III, No. 4

POLYETHYLENE PROCESSING TIPS

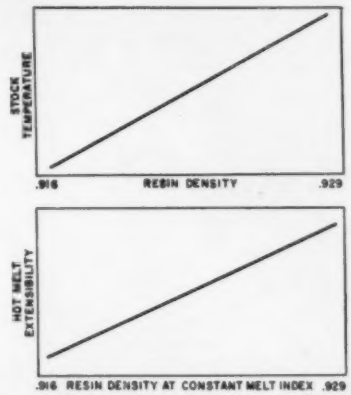
HOW RESIN DENSITY AFFECTS FILM PROPERTIES, EXTRUSION CONDITIONS

Extruders of blown or flat film will find, in working with some of the newer polyethylene resins of about .93 density, that they are significantly different from the more conventional resins of about .92 density—both in behavior during processing and in properties of the final film.

Operating Temperatures and Speeds Rise

As resin density increases from .916 to .930, higher stock temperatures are required—ranging from zero to 30°F higher, depending on the resin. At the same time, blown film does not have to be cooled as much. Since the higher density resins have a harder surface, are less tacky, and do not block readily, the temperature of a film of .930 density resin can be 10-20°F higher at the nip rolls of the take-up without introducing internal blocking.

The higher film temperatures at the pinch rolls help prevent wind-up wrinkling to which higher density films are susceptible (see U.S.I. Polyethylene Processing Tips, Vol. III, No. 3). Less cooling means faster production using higher density resins, and is also advantageous when space for cooling equipment is limited.



It should be remembered, in processing higher density resins, that the resulting films have lower impact strength than do films from lower density resins. Therefore, excessive roll pressures in blown film wind-up should be avoided, to prevent too sharp a crease in the flattened film cylinder, particularly in gussetted film. A sharp crease, when subjected to impact loading during film use, will frequently fail by tearing.

Also, as density increases from .916 to .930, resins have better hot melt extensibility—can be drawn down to thinner gauges. U.S.I.'s .929 density resin, for example, has been drawn down to less than 0.2 mils thickness in a regular production run.

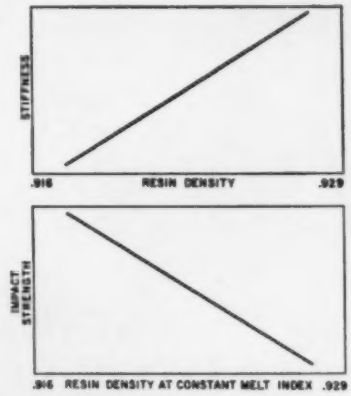
Films are Stiffer, Easier to Handle: Seal Hotter

Films extruded from higher density resins have more body and less stretch than do those made from conventional resins. This means that they are easier to handle on standard converting equipment and can be more easily used on high-speed converting and packaging machinery.

In heat sealing, as in extrusion, slightly higher temperatures must be used to effect a satisfactory seal with the higher density resins.

Clarity Up, Impact Strength Down

At resin densities of about .93, films are clearer, have less haze, higher gloss, greater transparency. They are stiffer, with more tensile strength, but have lower impact tear and impact strengths. Because they have harder surfaces, they are more abrasion-resistant. Heat resistance also increases. Permeability goes down (see U.S.I. Polyethylene Processing Tips, Vol. II, No. 2).



As you can see, the extruder's choice of resin density will depend largely on the film properties desired by his customer. For toughness, flexibility and good protection, low densities are indicated. For more stiffness, clarity and heat resistance, higher densities are coming into prominence.

U.S.I. offers a series of polyethylene resins, ranging in density from .916 to .929. U.S.I. technical service engineers can recommend the proper resin with the best balance of properties for your particular application. They will be glad to work with extruders and converters on processing problems as well.

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guide to

PETROTHENE

polyethylene resins

FILM EXTRUSION——

APPLICATION	GAUGE (mil)	ESSENTIAL PROPERTIES	recommended PETROTHENE RESINS
GARMENT BAGS	0.4 to 0.75	High draw-down, good clarity, high gloss, resistance to blocking, good slip.	207, 239
SOFT-GOODS BAGS	0.75 to 1.25	High draw-down, high clarity, good gloss, resistance to blocking, good slip.	206, 207
PRODUCE BAGS			
SMALL	1 to 1.25	Moderate toughness, clarity, gloss, resistance to blocking, good slip.	205, 210
LARGE	1.5 to 2	Higher toughness, fair clarity, gloss, resistance to blocking, good slip.	200, 205, 210
CHEMICAL PACKAGING BAGS	1.5 to 3	Toughness, resistance to blocking, good slip.	200, 204
CONSTRUCTION AND ARCHITECTURAL	4 to 6	Extreme toughness.	200, 301

FILM EXTRUSION—— *(cast and quenched)*

SOFT-GOODS BAGS	0.4 to 0.75	High draw-down, clarity, gloss, resistance to blocking, good slip.	239
OVERWRAP	0.75 to 2	Clarity, gloss, resistance to blocking, good slip.	239
PRODUCE BAGS	1 to 2	Moderate toughness, clarity, resistance to blocking, good slip.	200, 205, 210
CONSTRUCTION AND ARCHITECTURAL	4 to 6	Extreme toughness.	200, 301
AGRICULTURAL (MULCH)	0.75 to 2	Moderate toughness, high draw-down.	201-216
	2 to 6		102, 102-216

PIPE EXTRUSION	NSF approved for potable water	102-216
	Nonpotable water supplies	550-218
CALENDERING		102, 102-216

PETROTHENE TYPES RECOMMENDED *for different applications*

USE	ESSENTIAL PROPERTIES	recommended PETROTHENE RESINS
PAPER COATING	Good draw-down, freedom from odor, good adhesion, grease proofness, heat sealability	
	Best draw-down	207, 239
	High resistance to permeability	100, 239
	Minimum "neck-in"	100, 200
	Balanced properties	205, 210
WIRE AND CABLE COATING	Excellent dielectric properties	
	Excellent resistance to environmental stress cracking	
	High frequency insulation	300-6
	Wire and cable jackets, where unusual stress crack conditions are encountered	300-200
	Primary insulation for telephone cables, general insulation where color coding is required	300-Color Code
	Good resistance to environmental stress cracking	
	High frequency coaxial cables; primary insulation for telephone cables, multi-conductor control cables, power cables	301-6
	Weather resistant wire and cable; neutral supported secondary and service drop cable	301-200
	WD1/TT infantry field wire	301-202
	Primary insulation for telephone cables; general insulation where color coding is required	301-Color Code
	General-purpose applications	
	Non-critical, non-specification insulation	302-6
	TV antenna lead-in wire	302-506
INJECTION MOLDING	Fast flow, maximum stiffness	
	Size:	
	Very large (>20 oz)	208, 241
	Very large (>20 oz), high resistance to low-temperature brittleness and shattering	202
	Large (10 to 20 oz)	202, 203, 207, 208
	Small (6 to 10 oz)	201, 203, 206, 207, 239
	Very small (<6 oz)	200, 204, 205
	Best transparency and gloss	207, 208, 241
	Best freedom from warp (low level of locked-in stresses)	202
BOTTLE BLOWING	Best appearance	102, 206
	Highest environmental stress cracking resistance	301
THERMOFORMING	Stiffness, chemical resistance, low water absorption	205, 239
	Maximum resistance to sag	239, 301
	High stiffness and thin walls	239
	Optimum toughness and great flexibility	301
	Good balance of end properties	205

FORM: Solid cubes approximately ⅛" on a side.
COLOR: All PETROTHENE types are available in various colors as well as natural.
PACKAGING: Polyethylene coated multi-wall bags—net weight 50 lbs., 1500 lbs. and 9000 lbs. U. S. Rubber Sealdbins. Palletized shipments upon request.
MINIMUM ORDER: 50 lbs.
TERMS: Net 30 days.
AVAILABILITY: Warehouse stocks are maintained in most major processing areas. Your nearest U. S. I. Sales Office will give you detailed information on delivery dates.
TECHNICAL SERVICE: For technical assistance contact your nearest U. S. I. Sales Office.

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at which the fluorine resins are processed and are, therefore, especially stable and non-reactive, Ferro asserts.

In addition, it is claimed, Ferro pigments are treated so that they contain a minimum of soluble salts. The elimination of these salts reduces agglomerates, thus making it easier to disperse the pigments, and also improves the electrical properties of the colors.

Catalin obtains license

Under the terms of a 10-year license agreement with Union Chimique Belge, S.A., Brussels, Belgium, Catalin Corp. of America, 1 Park Ave., New York, N. Y., will manufacture and sell emulsions and solutions of acrylic polymers used for paints, coating, and adhesive applications.

The Belgian company will supply all data required for the manufacture of the products covered in the agreement. The companies will also exchange technical information regarding improvements and new developments in the manufacturing processes, formulations, and applications of the chemical specialties under license.

Catalin will produce the chemical specialties at its plants in Fords, N. J.; Thomasville, N. C.; and Calumet City, Ill.

Pigments for flowers

Twenty-seven colorants for dry blending with polyethylene have been developed by H. Kohnstamm & Co., Inc., 161 Avenue of the Americas, New York, N. Y. Designated the Floral Line, the new colorants are currently being sold overseas in countries where the manufacture of artificial flowers is an important industry.

Blue pigment

A very red-shade phthalocyanine blue pigment, claimed to have color stability at elevated temperatures, has been developed by the Pigments Div., American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y. Designated Cyan Blue XR-55-3770, the new colorant is reported to be an all-purpose pigment which is crystal-stable in the aromatic solvents and/or plasticizers generally used by the plastics industry.

In laboratory tests, this full-strength copper phthalocyanine pigment is said to have displayed excellent working properties and a very high degree of color stability in polystyrene. When exposed to the high temperatures usually associated with polystyrene processing, this pigment retained its excellent initial hue and increased slightly in strength, the company reports. It is said to have good lightfastness and acid and alkali stability.

Larger saran-lined pipe

Standard 8-in. saran-lined pipe has been added to The Dow Chemical Co.'s group of piping products, which now includes nine sizes of pipe, valves, and fittings from 1- through 8-in. diameter. Previously, the largest diameter of pipe offered was 6 inches.

Saran-lined pipe is supplied with threaded ends in maximum lengths of 10 ft. and can be adapted to join to other corrosion-resistant piping systems or to standard steel pipe.

Distribution of saran-lined products is handled by Saran Lined Pipe Co., Ferndale, Mich.

Tests on 10-mil polyethylene

A testing program on its new heavy-duty polyethylene has been completed by the Plastics Div., Visking Co., Div., of Union Carbide Corp., Terre Haute, Ind. The company reports that when bags made of 10-mil Visqueen heavy-duty polyethylene tubing were filled with seed or feed and dropped from a height of 4 ft. onto various surfaces from standing and moving positions, breakage was kept to half the amount chalked up when multi-wall bags were used. In addition, the tubing proved more moisture and chemical resistant than competitive packaging materials.

Visqueen polyethylene tubing is said to offer economical advantages because of its long life, re-use scrap value, and lower tare weight. Transparent, opaque, and colored tubing can be imprinted.

Industrial uses for urethane foam

Seals and vibration dampeners made of urethane foam encased in vinyl tubing, are offered for various industrial uses by The Sterling Alderfer Co., 3850 Granger Rd., Akron 13, Ohio. The product, known as Foamedge, can be supplied in any length, with diameters from 1/4 to 3/4 inch. It is soft and flexible and is said to compress to a fraction of its diameter, with full recovery when released.

The material is being used as an air seal in dairy cooling cabinets, and as vibration dampeners in aviation radar units. Since it combines thermal insulation and shock absorption, it can also find application in air conditioning, refrigeration, soundproofing, etc.

Foamedge is self-adhesive and is claimed to adhere to clean metal, wood, glass, and most plastics. It is available in strips cut to length and mounted on cards, or in reels.

New intermediate

Iminodiacetic acid, a difunctional acid used as an intermediate for surface active agents, complex salts, and chelating agents, is now being produced in commercial quantities by The Dow Chemical Co., Midland, Mich. Likely markets for the chemical are in the plastics, general chemicals, textile, and pharmaceutical fields.

Acrylonitrile capacity doubled

Production capacity for acrylonitrile has been doubled at the Institute, W. Va., plant of Union Carbide Chemicals Co., Div. of Union Carbide Corp.

Acrylic fibers are the largest consumers of acrylonitrile. Terpolymers made from acryloni-

The Plastiscope

trile, butadiene, and styrene—the so-called ABS resins—are plastics materials with high impact and high distortion strength which have found use in radio cabinets, golf clubs, and vacuum cleaners, for example.

Other uses for the chemical are in the production of nitrile rubbers and textile softeners.

Anhydride prices reduced

Prices of dodecenyl succinic anhydride have been reduced from 89 to 75¢/lb. in truckload lots by National Aniline Div., Allied Chemical Corp., New York, N. Y. Smaller quantities have been cut from 90 to 76¢/lb. All prices are based on delivery east of Denver.

This anhydride is used as a curing agent for epoxy resins, as an intermediate for corrosion inhibitors, and in fungicides. It is also said to be of value in the preparation of rubber chemicals and as a possible chemical intermediate for low-temperature plasticizers.

Modern Packaging to institute unique program

Effective with its January issue, *Modern Packaging* magazine is launching a new program said to be revolutionary in business-paper publishing. According to Alan S. Cole, president and publisher of Breskin Publications, "the unique feature of the plan is the utililzation of an editorially-trained, 20-man Readership Development Staff charged with insuring 'supervised readership' of the magazine by its newly augmented audience of large-scale packagers throughout industry."

Members of the new group will be permanently stationed throughout the country in areas of major packaging activity and will make direct personal calls on readers to demonstrate the effective use of the publication as a working tool, interpret its editorial content in terms of each reader's specific packaging interests, and offer *Modern Packaging's* home office Reader Service counselling facilities for package design and planning, as well as production.

Another phase of the new program is to identify by name the 16% of the country's plants that account, according to U. S. Census data, for just short of 90% of total packaged goods output, and to identify the individual packaging executives in these companies.

Mr. Cole states that "wherever gaps in the magazine's existing coverage are detected, they will be corrected by additions to circulation. On the basis of work already completed, we expect that the January issue circulation will reach about 32,000 as compared with 24,000 at present."

Low-gage polyethylene film

The addition of 0.0004- to 0.0007-in. polyethylene film to its current line of extruded tubular films has been announced by Food Film, Inc., P. O. Box 258, Caldwell, N. J.

The company uses the extrusion technique rather than the conventional blown method and has expanded its facilities to produce these lighter films with close width control, good gage control, and very little scrap loss.

They are designed primarily for the laundry and dry cleaning fields.

Plastic pipe training program

An educational field sales training program for wholesale plumbing, hardware, and oil field supply salesmen has been launched by Southwestern Plastic Pipe Co., Mineral Wells, Texas, manufacturer of plastic tubular goods.

Designed to help salesmen to better understand the types, new developments in plastic pipe materials, uses, and limitations in various fields of application, the program is being presented in a series of group meetings. Meetings scheduled currently will cover jobber and supply store outlets in Texas, Oklahoma, Colorado, and Arizona.

Sealant for polyethylene film

Problems of joining and patching polyethylene film used in agriculture and as a water vapor and dust barrier in the construction field can now be solved with a pressure-sensitive, paper-backed polyethylene tape introduced by Gering Products, Inc., Kenilworth, N. J.

Tradenamed Ger-Pak Miracle Tape, it comes within general building requirements, including specifications of the FHA. The tape is easy to apply by removing the paper backing and then firmly pressing the tape smooth in all directions.

Lightweight vinyl film

Vinyl materials stocked by H. B. Strauss Co., 131 Water St., New York 5, N. Y., now include 3-gage, 54-in. wide, flat and taffeta finish lightweight virgin vinyl film in a full range of colors. Previously, the firm's line started with 6-gage material.

According to the company, makers of a range of plastic end products can now obtain a complete line of regular, first quality, lightweight and heavy-gage vinyl plastics from the same source at mill level prices.

Strauss is further expanding its line to include 2-gage vinyl film, as well as boilable and scented vinyl.

Adhesives

For gluing metals. Bonds with strengths of over 5000 p.s.i. on aluminum and steel can now be formed with an improved, one-component, epoxy-based adhesive developed by H. B. Fuller Co., 255 Eagle St., St. Paul, Minn. Called Resiweld #105, the product comes ready to use and hardens permanently when cured with heat at 350° F. for 25 to 40 minutes.

Resiweld #105 is a metallic colored thick liquid and can be applied to metals and heat-resistant non-metals by brush, trowel, caulking gun, or pressure feed systems. The surfaces to be joined do not require clamping or

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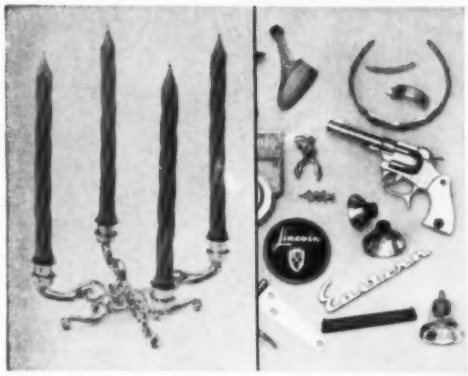

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Vacuum coating can help you open up new markets by adding a quality appearance to your products. Brilliant metallic finishes can be applied in a wide range of colors at surprisingly low cost.

Today's vacuum coatings are brighter than buffed and polished electroplating, cost less, and in some applications, stand up better.

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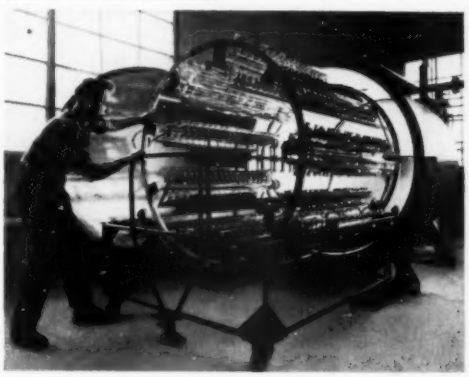

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Small turnings of cylindrical shapes formed from round rods and tubes for all types of applications.

Range of sizes is from ⅛" to 1" diameter and up to 7" long. We hold tolerances of .002 on plastic and .005 on wood, plus or minus.

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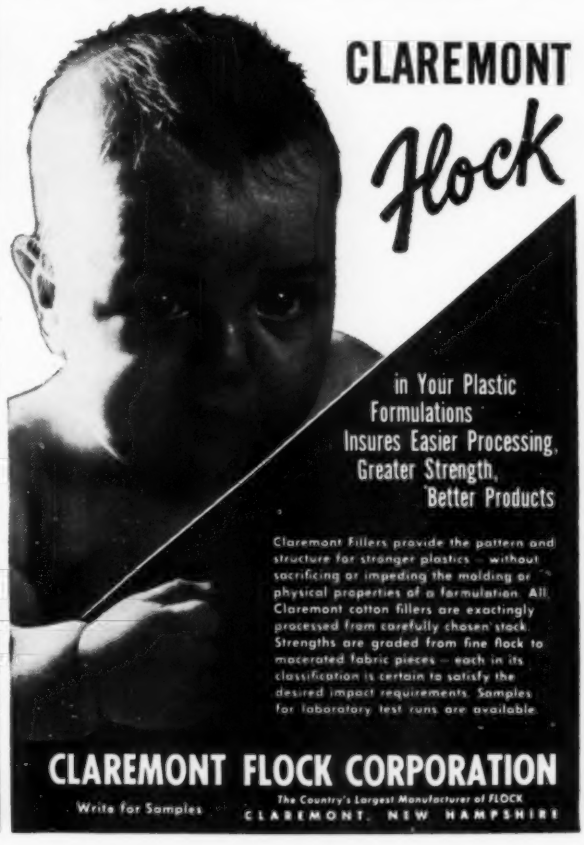

CLAREMONT *Flock*

in Your Plastic Formulations Insures Easier Processing, Greater Strength, Better Products

Claremont Fillers provide the pattern and structure for stronger plastics – without sacrificing or impeding the molding or physical properties of a formulation. All Claremont cotton fillers are exactingly processed from carefully chosen stock. Strengths are graded from fine flock to macerated fabric pieces – each in its classification is certain to satisfy the desired impact requirements. Samples for laboratory test runs are available.

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Write for Samples
The Country's Largest Manufacturer of FLOCK
CLAREMONT, NEW HAMPSHIRE

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other mechanical fastening during the cure period.

Bonds formed are said to be resistant to moisture, water, temperature changes, solvents, and most chemicals.

Contact adhesive. A water-base contact adhesive, claimed to be non-flammable, essentially odorless, and non-hazardous, is being marketed by Formica Corp., subsidiary of American Cyanamid Co., Cincinnati, Ohio.

Designated Safe-Bond, the adhesive is said to have a spread rate of 300 to 320 sq. ft./gal., enough to apply 150 to 160 sq. ft. of decorative laminate. It can be brushed, sprayed, or rolled on plastic laminates, plywood, particle board, etc.

Epoxies

Anti-foam spray. Hysol M-453, an anti-foam agent especially developed to reduce surface tension on liquid epoxy casting systems, has been introduced by Houghton Laboratories, Inc., Olean, N.Y.

The product is packaged in an aerosol spray can. It is sprayed in a fine mist above the resin surface and allowed to settle gently. This allows air bubbles to break easily and eliminates surface bubbles and pinholes on cured castings, according to the company. An advantage of the spray method is that only a small amount of the product is required.

Hysol M-453 is best used after the liquid compound has been introduced into the mold but can, if necessary, be used before pouring.

Tooling resin system. Satisfactory service at temperatures up to 550° F. is said to be possible with an epoxy resin tooling system developed by Hastings Plastics, Inc., 1551 12th St., Santa Monica, Calif. Known as Hapex #1254 Thermkast, the two-component system can be cured at temperatures considerably below its heat distortion point and still attain ultimate properties.

The new material was designed primarily for use in platen heated tooling, internally heated tooling, injection molds, high-temperature laminating molds, and high-temperature vacuum forming molds.

According to Hastings, pilot tools made with the highly metallic-filled resin and paste hardener established that Thermkast produced excellent surface properties at elevated temperatures. A Barcol hardness of 70 was obtained at 550° F. and the tooling had an extremely high gloss.

Thermkast is reported to have a pot life of from 4 to 6 hr. and, although of relatively high viscosity, disperses readily enough to permit hand mixing in quantities up to 5 pounds.

Expansion

Federal Tool Corp., 3600 W. Pratt Blvd., Chicago 45, Ill., has installed a new 300-oz. plastic injection molding machine at a cost of over $150,000. It is 11½ ft. high, requires floor space of about 12 by 36 ft., and weighs 215,000 pounds.

The machine, designed and built by **Hydraulic Press Mfg. Co., a Div. of Koehring Co.,** will mold up to 300 oz. of plastics materials per cycle. It has a mold clamping force of 1500 tons, a 60-in. stroke, and will accommodate a mold 4 by 6 feet. The maximum daylight opening is 120 inches. The machine is a completely self-contained, all-hydraulic operating unit and is said to rival the speed of many smaller machines.

Designed for rapid production of large pieces, the machine will produce mobile home bathtubs; 50-gal. drums; industrial containers; laundry baskets; clothes hampers; garbage cans; and larger refrigerator, radio, and television parts.

In terms of production capacity, the new machine represents an increase of over 40% for Federal; and, in terms of capital investment, it is an increase of over 60 percent.

National Distillers and Chemical Corp., 99 Park Ave., New York, N. Y., has acquired the **Kordite Div.** of **Textron, Inc.**

Kordite, an integrated converter of plastics packaging materials, will operate as an independent subsidiary of National with no change in personnel.

Imperial Chemical Industries, Ltd. will construct a 30 million-lb./yr. terephthalic acid plant at its Wilton Works, near Middlesbrough, England, which will approximately double the company's present output.

The plant, which will be designed by **Scientific Design Co., Inc.,** New York, N. Y., is an element in the ICI program to extend its production of Terylene polyester fiber and Melinex polyester film.

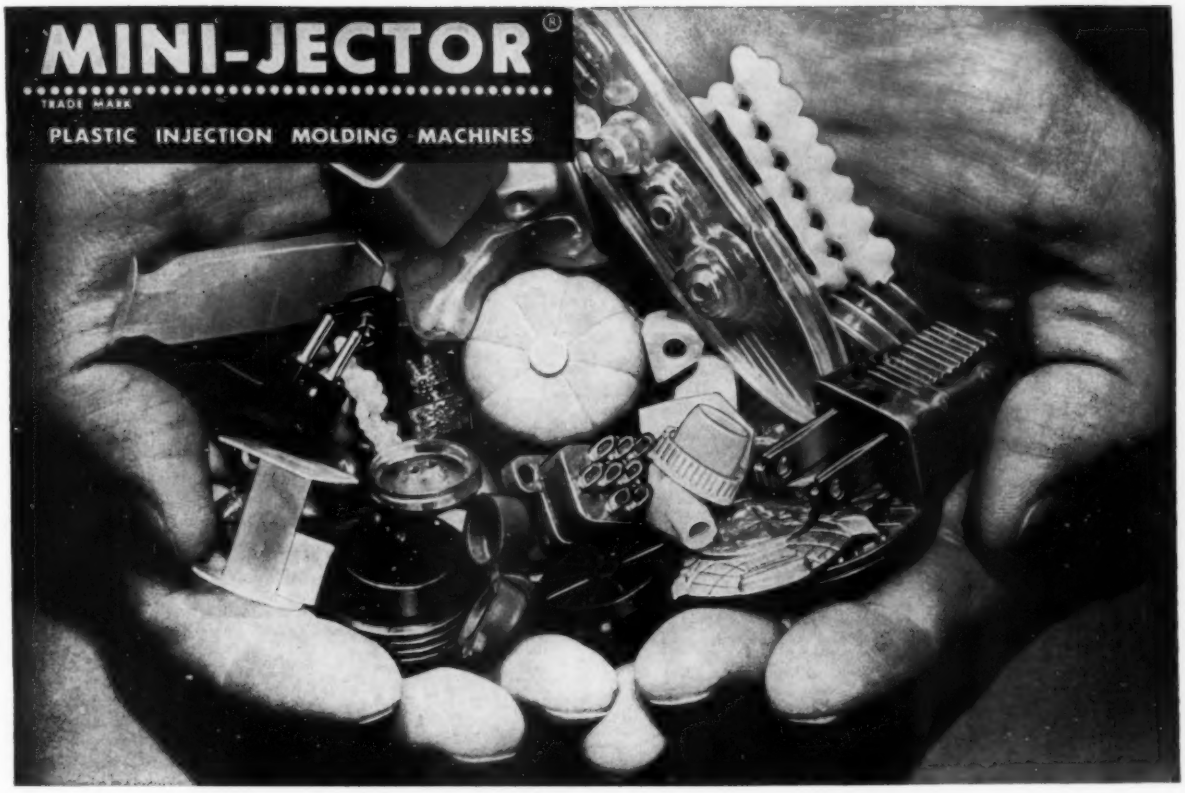
Monsanto Chemical Co. has completed facilities at its Long Beach, Calif., plant for bulks custom blending of plasticizers. The company will make any feasible blend of its plasticizers if the order is in tank wagon quantity (approximately 3000 gal.). Monsanto markets more than 75 different plasticizers.

Custom blended plasticizers are also available from Monsanto's plants at Everett, Mass., and St. Louis, Mo.

Brillium Metals Corp., Long Island City, N. Y., manufacturer of metal-coated plastic housewares, has started construction on a 45,000-sq. ft. factory and office building in Jamaica, L. I., N. Y.

The company, an affiliate of **Vacuum Metalizing Corp.,** Long Island City, will consolidate its manufacturing and distributing facilities in the new structure, which is expected to be completed by the end of the year. The plant will employ over 250 persons.

Royal Mfg. Co., Prescott, Ariz., is expanding its manufacturing operations into the Chicago, Ill.,



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Save thousands of dollars in mold costs with MINI-JECTOR. Eliminate "big press" high-per-piece tooling expenses!

Over $4000 saved on one of the above items alone. Details on request. The more variety, the bigger the savings. Flexible, efficient MINI-JECTOR Plastic Injection Molding Machines answer the critical need for lower cost development and production of fast-changing varieties of small precision-molded plastic items. Savings begin with low initial investment for machine (under $1000) and mold-blanks (as low as $29.50). More important are the major savings in time, trouble and money developing and producing wide varieties of items, by eliminating complex, costly big-press tooling where not required. MINI-JECTOR solves your "tight margin" runs (from test samples to moderate production); also tricky "insert" molding up to 1 oz. capacities in all thermoplastics, **including Nylon.** Compact, simple to operate; lever and push-button control models, air or hydraulic power to fit your facilities.

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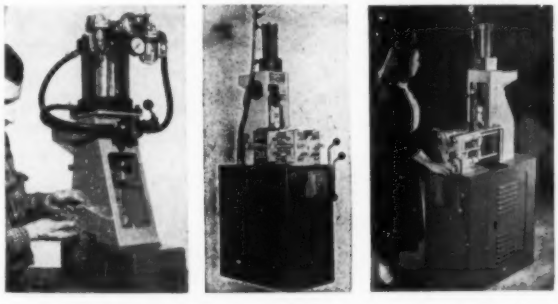

(left) **Model 45 "Wasp"** (bench), fast, low-cost insert molding and encapsulating up to 1 oz. (center) **New "Universal" Model** combines features of 4 most popular MINI-JECTORS. (right) **Model 60 "Super-Hornet"** for most economy in moderate, conventional molding. Other models to suit your exact needs. (See catalog.)

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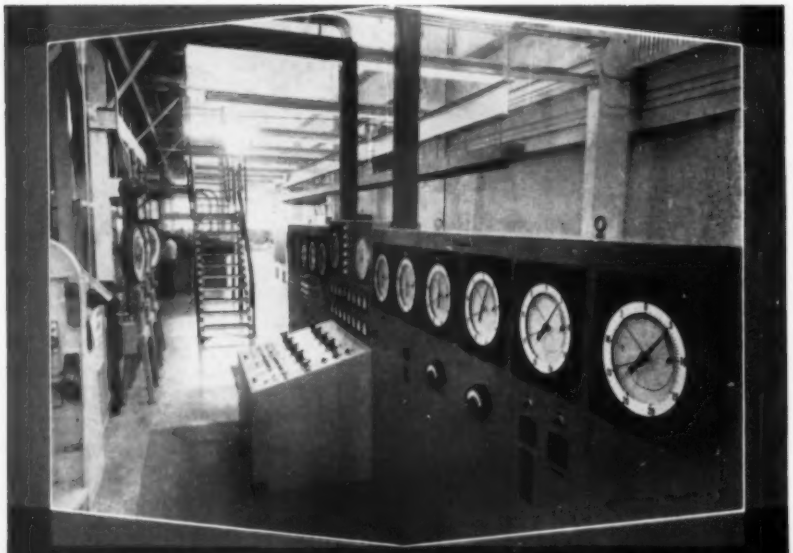

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The Plastiscope

area by the acquisition of a 25,000-sq. ft. plant at 2711-23 N. Pulaski Rd.

The Chicago operation will have complete facilities for the production of private mold designs, as well as for manufacturing and warehousing of Royal's line of stock bottles, ranging in size from ¼ oz. to 1 gallon. More than 350 persons will eventually be employed there.

The company's headquarters will remain in Prescott, where construction on a building is nearing completion which will more than triple the Prescott warehouse space.

J. M. Nash Co., Milwaukee, Wis., manufacturer of sanding machines for plastics and wood, has acquired **Canvas Products Corp.**, Fond du Lac, Wis., which also operates under the names of **Can-Pro Corp., National Sports Co.**, and **Fond du Lac Tent & Awning Co.**

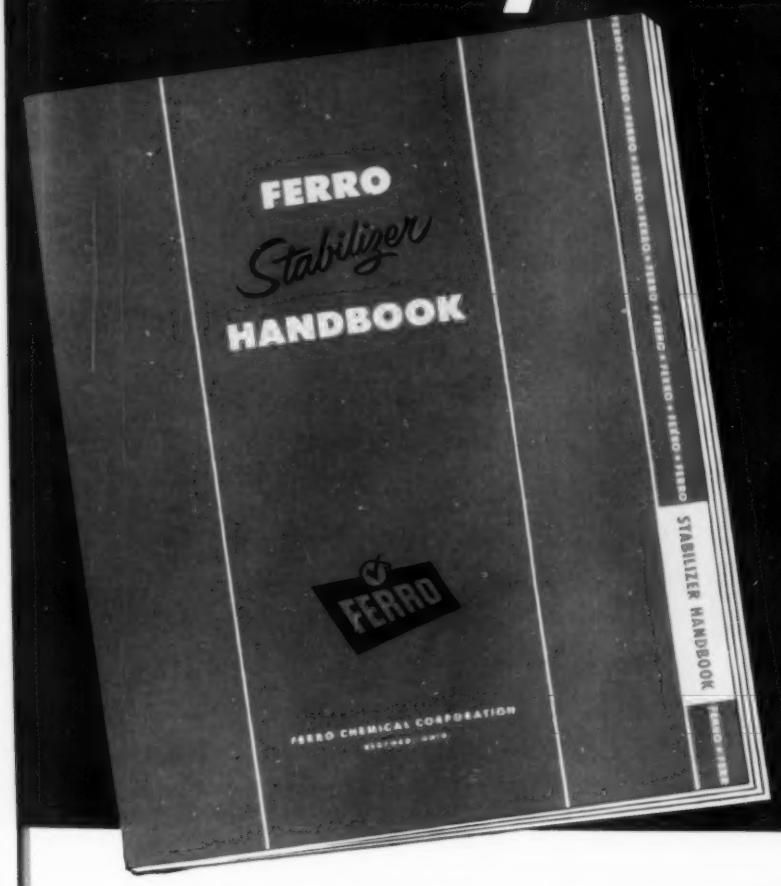
Perry C. Goodrick, president of Canvas since 1945, remains as a consultant and advisor; **Arnold F. Firle,** formerly vice president, appointed to the newly created post of executive vice president and general manager; **Arthur Klawitter** will continue as plant manager.

Minnesota Mining & Mfg. Co., St. Paul, Minn., has assumed the epoxy resin formulating business developed by **Minneapolis-Honeywell Regulator Co.**, Minneapolis, Minn. Potting, casting, bonding, foaming, and tooling resins will now be available from 3M.

The Mead Corp., Dayton, Ohio, manufacturer of paper, paperboard, and wood pulp, has purchased a substantial interest in **Lamex, Inc.**, Norcross, Ga., producer of polyethylene products for the paper, textile, agriculture, and food industries.

Comet Industries, 9865 Franklin Ave., Franklin Park, Ill., announces plans to establish a Puerto Rican affiliate to produce

New Handbook of Vinyl Stabilizers



New Ferro Stabilizer Handbook gives you latest *complete* data on stabilizing vinyl products.

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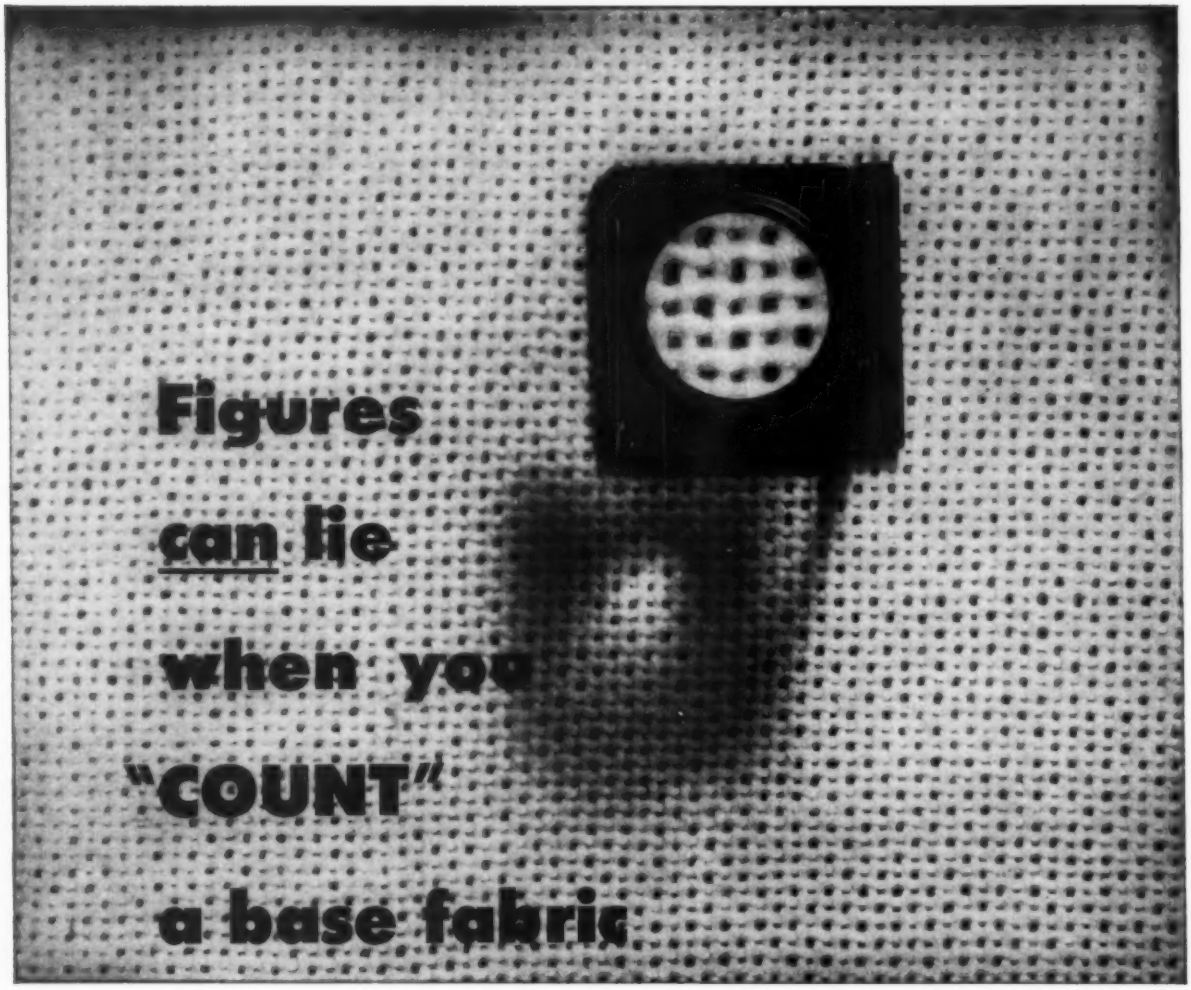

Yarns-per-inch "count" of grey fabric can be completely misleading because of changes produced by finishing and subsequent processing!

"Count" tells how open or tight a woven fabric is. The number of yarns per inch of cloth affects absorbency, adhesion, permeability, strength, bulk, flexibility and other characteristics related to fabric-reinforced plastic or rubber products. But if count is taken in the "grey," dimensional changes caused by pre-shrinking, heat-setting, calendering, napping, singeing, pre-dipping or other processes will not have been considered—and end-product performance may suffer.

Of course, thread count is but one of many factors affecting fabric performance. When your base fabric is one of the wide variety provided by Wellington Sears for coating, laminating, combining and rubberizing, you know that everything has been considered in the light of *your specific need*. And moreover you know that a century of experience is working for you, to anticipate and help solve your basic fabric problems. For free booklet, "Fabrics Plus," write Dept. K-10, Wellington Sears Co., 111 W. 40th St., New York 18, N. Y.

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The Plastiscope

its custom-made machines for the plastics industry. The company intends to build a 11,500-sq. ft. plant in Caguas, P. R., and will supply machines for plastics packaging, forming, vacuum molding, etc. to the United States and Latin America, as well as to Puerto Rico.

Chas. L. Huisking & Co., Inc., New York, N. Y., merchandiser and manufacturer of raw materials for the pharmaceutical industries, has acquired the assets of **Glyco Products Co., Inc.,** New York City, producer of chemicals for the plastics, electronics, paper, metals, paint, textile, and food industries.

Process Engineering & Machine Co., Inc. (PEMCO), fabricator of heat exchangers, tanks, pressure vessels, reactors, and allied equipment, has opened new plants and offices at York St. and Dowd Ave., Elizabeth, N. J.

Star Plastic Specialties, Inc. has opened a plant at 215 A St., Boston 10, Mass., fully equipped for blow molding operations. The company will operate as an affiliate of **Northeastern Plastics, Inc.** at the same location.

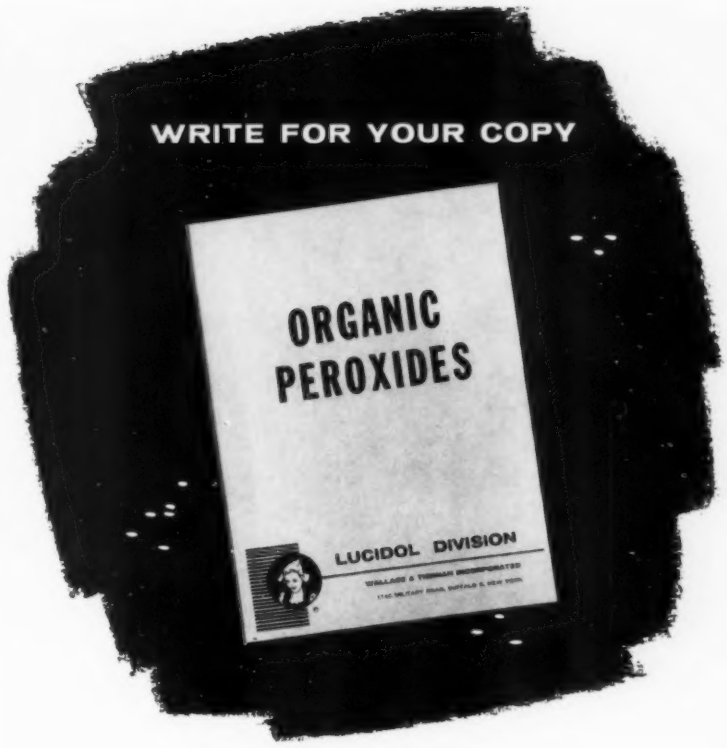
Deceased

Robert E. Brannan, of **Bakelite Co.,** died at the age of 66 of heart failure in Summit, N. J. He joined Bakelite in 1923 and retired on January 1, 1957. Prior to joining Redmanol Co., which was later to become Bakelite Co., he spent eight years coaching college athletics at Ottawa University and organized and coached the Staley football team in Chicago, Ill., now known as the Chicago Bears.

R. E. Brannan

Among his many accomplishments were development of phenolic washing machine agitators, phenolic molded drawers, and

(*To page* 238)



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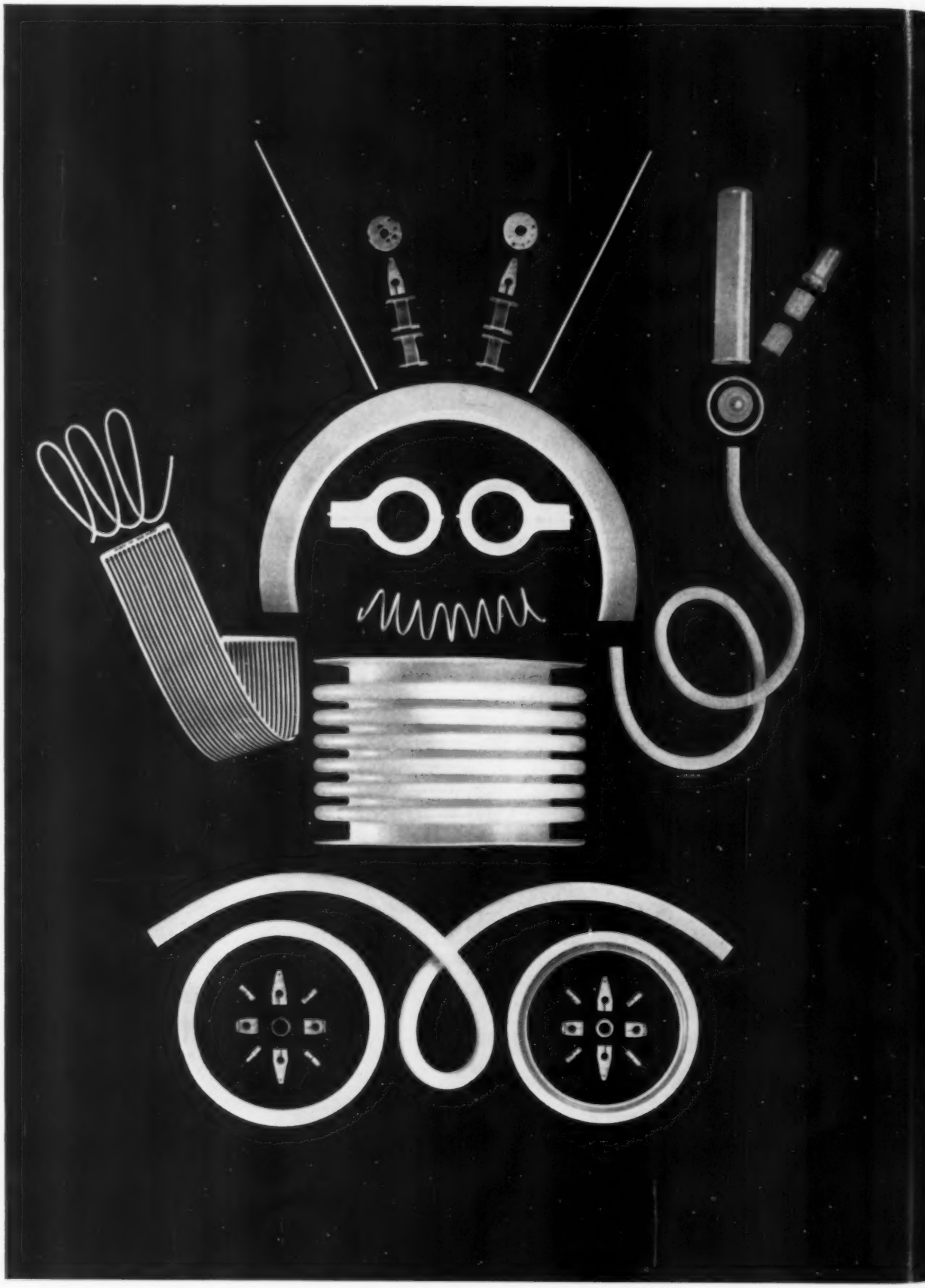

3M CHEMICALS *3M Chemicals opening new worlds of use for plastics*

INSULATES electrical components despite moisture, violent chemicals, temperature extremes!

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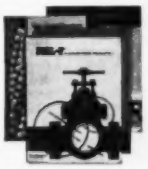
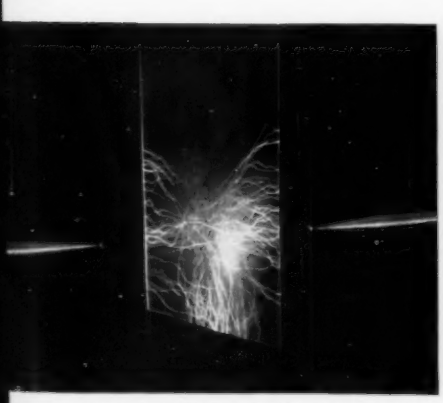
Enter, from the left, a new champ! He represents a winning combination of unique properties, invaluable in electrical manufacturing and electronics. Each component is fabricated of—or coated with—one of the many KEL-F halofluorocarbons.

KEL-F polymer has the high dielectrical strength that provides superior insulation at all frequencies (volume resistivity -1.2×10^{18} ohm-cm at 50% relative humidity and 25° C.). Not only that! As shown below, this 3M chemical product exhibits remarkable chemical and thermal stability—amazing resistance to corrosive chemicals, humidity, abrasion and temperature extremes.

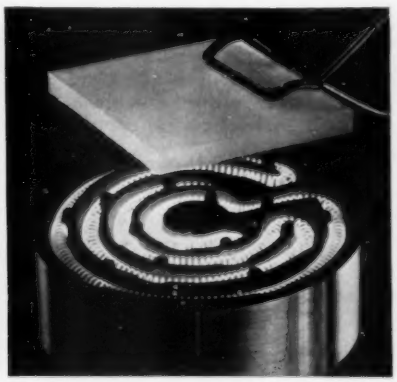
Workability? KEL-F polymer can be compression-, transfer-, or injection-molded on standard equipment, extruded into tubing or wire insulation, or punched, drilled or machined. The result: the final cost of plastic products molded or extruded from KEL-F polymer is often greatly reduced.

The entire line of KEL-F halofluorocarbons—molding resins, dispersions, elastomers, laminates, waxes, greases and chemicals—exhibits properties that increase efficiency and economy in electrical and many other operations. Investigate KEL-F polymer—write for free literature giving complete data: Chemical Products Group, 3M Company, Dept. WQ58, St. Paul 6, Minnesota.

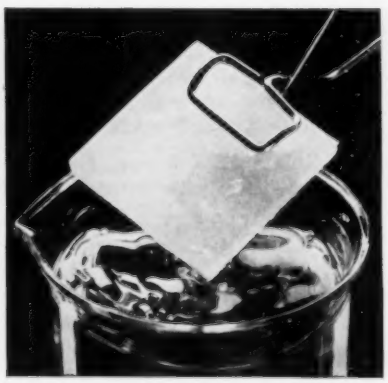




M CO. **HIGH DIELECTRIC STRENGTH:** Short time 1/16" —530 v/mil. Extremely high-volume resistivity: 1.2 x 10 to the 18th power (1.2×10^{18}) ohm-cm at 50% relative humidity and 25° C. Arc resistance: > 360 sec. Superior insulation at all frequencies.



EXCELLENT THERMAL STABILITY: Wide temperature range (−320° F. to +390° F.) without any resulting material decomposition, or any mechanical failure. KEL-F displays zero-moisture absorption; is readily molded.



EXCEPTIONAL CHEMICAL STABILITY: After seven days immersion in either 37% hydrochloric acid, 90% hydrogen peroxide, 98% fuming nitric acid, 95% sulphuric acid, or anhydrous ammonia, weight change at 25° C reads 0.0%.

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ACCURACY—A 1:1 ratio lever system in a complete precision scale with over-under indication provides extreme accuracy. Precision controls cut off feed to scale following all vibrations in the press. No material shakes from feeder following cut off.

SIMPLICITY—Clean, functional design keeps the number of controls to a minimum for ease of set up and operation.

ADJUSTABILITY—Fine adjustments are made possible by a dual-notched and graduated beam, plus calibrated weights and small increment—1/100 oz. or 1/4 gram increments can easily be made. Avoirdupois or metric system optional at no extra cost.

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radio cabinets. Mr. Brannan was a Plastic Pioneer and a charter member of The Society of the Plastics Industry, Inc.

Meetings

Plastics groups

November 6: Society of Plastics Engineers, Inc., Regional Technical Conference, Sheraton Hotel, Philadelphia, Pa. Subject: "Advances in Injection Molding."

November 13: Society of Plastics Engineers, Inc., Regional Technical Conference, Ambassador Hotel, Los Angeles, Calif. Subject: "Plastics in Building and Construction."

November 17-21: The Society of the Plastics Industry, Inc., 8th National Plastics Exposition, International Amphitheatre, Chicago, Ill.

November 17-21: The Society of the Plastics Industry, Inc., S.P.I. Annual National Conference, Morrison Hotel, Chicago, Ill.

Other meetings

October 10: University of Akron, Meeting, Room 107, Knight Hall, University of Akron, Akron, Ohio. Subject: "A Soluble Catalyst for the Polymerization of Ethylene."

November 4-6: Packaging Association of Canada, Canadian National Packaging Exposition, Automotive Building Exhibition Grounds, Toronto, Ontario, Canada.

November 5-6: Society of Vacuum Coaters, Annual Meeting, Hotel Statler, Detroit, Mich.

November 7: University of Akron, Meeting, Room 107, Knight Hall, University of Akron, Akron, Ohio. Subject: "Stereospecific Olefin Polymers."

November 12-13: Chemical Market Research Association, Meeting, St. Paul Hotel, St. Paul, Minn. Subject: "Adhesives."

December 2-4: U. S. Army Signal Research and Development Laboratory and Industry, 7th Annual Wire and Cable Symposium, Berkeley-Carteret Hotel, Asbury Park, N. J.

Companies . . . People

B. F. Goodrich Co., Industrial Products Co.: James C. Richards, Jr., with the company 24 years and formerly VP—sales, **B. F. Goodrich Chemical Co.,** appointed VP—sales of the Industrial Products firm. He succeeds **R. V. Yohe,** who was elected pres. and chief executive officer of **B. F. Goodrich Canada.**

J. C. Richards

B. F. Goodrich Chemical Co.: O. E. Isenberg, gen. mgr. of the **Harmon Colors Div.,** elected pres. of the **Dry Colors Manufacturers' Association.**

Allied Chemical Corp., Plastics and Coal Chemicals Div.: Leon W. Miller, with the company over 42 years and formerly mgr. of chemical sales, now dir. of chemical sales of the division. **Robert Slater,** who previously handled Plaskon publicity for the company's **Barrett Div.** from which Plastics and Coal Chemicals Div. was formed, appointed adv. mgr.

Air Reduction Co., Inc.—Air Reduction Chemical Co.: J. M. Tinnon, formerly sales mgr., named VP in charge of sales and new product development activities. **R. A. Wilson,** formerly mgr. of operations, appointed VP — production and engineering. **Dr. G. B. Carpenter,** previously mgr — development staff, now dir. of development for the chemical division.

Colton Chemical Co.: Colby Dill, Jr. appointed sales rep. and will headquarter in Elkton, Md.

Du Pont, Polychemicals Dept.: A Research and Development Div. has been formed within the Polychemicals Dept.

Dr. Frank C. McGrew, formerly asst. dir. of the Research Div., will head the Research and Development Div. **James B. Castner,** previously mgr. of the plant's technical section, named dir. of laboratories. Responsibility for technical programs for the department's various product groups is assigned to **Dr. William E. Grigsby** as dir. of plastics research and development, **John V. E. Hardy** as dir. of nylon intermediates research and development, and **Dr. Marcus A. Naylor, Jr.** as dir. of industrial chemicals research and development.

Within the Research and Development Div., a group of product mgrs. with broad authority over the conduct of research programs on various products has been established as follows: **Dr. Daniel E. Strain,** hydrocarbon polymers; **Dr. Gerald F. Curtin,** nylon and vinyl polymers; **Dr. D. H. Johnson,** fluorocarbon polymers; and **Dr. W. H. Linton,** Delrin acetal resin.

A realignment of functions within the Manufacturing Div. of the Polychemicals Dept. to provide closer coordination with Research and Development and Sales Divs. along product lines has also been announced. **William R. Diver** and **William A. Franta** named product mgrs. — plastics; **John R. McConnell,** product mgr. — industrial chemicals; **Everett B. Yelton,** product mgr. — nylon intermediates.

Dr. Warren J. Brehm promoted from research supv. to sr. supv. in the Research Div. He will continue to direct the research of a group of chemists investigating the synthesis of new plastics and new chemicals.

Film Dept.: Albert S. Allen, a special representative of the sales development and technical service section of the department, has retired after a career of 33 years with Du Pont.

Escambia Chemical Corp.: Dr. L. H. Sutherland appointed asst. dir. of research at the company's new research center in Wilton, Conn. **Francis G. Mendrey** named sales rep. for vinyl resins and will serve the Middle Atlantic States.

General Aniline & Film Corp. has consolidated the research programs of its Dyestuff and Chemical Div. and transferred the major section of the division's technical laboratory from 435 Hudson St., New York, N. Y., to the company's Central Research Laboratory in Easton, Pa. The Hudson St. laboratory, which served **General Dyestuff Co.** and **Antara Chemicals,** will be integrated into an applications research and technical service function of the Research Dept.

Plax Corp.: Samuel F. Schillaci, formerly asst. to the pres. and prod. mgr., elected a VP. **William R. Bolton** appointed gen. sales mgr., containers, and **A. K. Thorn** gen. sales mgr., film and sheet. **Gilbert B. Luce** succeeds Mr. Bolton as New York dist. sales mgr.; **E. S. Marsh** replaces Mr. Thorn as Chicago dist. sales mgr.

The Glidden Co. has established a plastics research and development laboratory at its Paint Div. Research Center at 12430 Elmwood Ave., Cleveland, Ohio.

The laboratory will be devoted primarily to research and development work in connection with the firm's Glidpol polyester resins; rigid polyurethane foams for insulating and structural applications under the tradename Glidfoam; and Glid-Rez butoxy resins for coating and casting.

Dr. H. J. Kiefer, coordinator of research, will supervise the new laboratory.

American Cyanamid Co. — Industrial Chemicals Div.: A Process Chemicals Dept. has been formed through the merger of the company's Heavy Chemicals and Manufacturers Chemicals Depts. The new department will handle an extensive line of intermediate, heavy, and specialty chemicals for the process industries, including cyanamide and its derivatives — dicyandiamide and melamine — alum and acids, phthalic and maleic anhydride, surface active agents, cyanuric chloride, etc.

H. C. Milton and **R. M. Goddard,** both with the company over 20 years, named respective mgr. and sales mgr. of the new department. Mr. Milton was formerly mgr. of the Manufacturers Chemical Dept. and Mr. Goddard asst. mgr. of the Heavy Chemicals Dept.

Formica Corp.: Alfeo J. Martina, head of **A. J. Martina & Associates,** Cincinnati, Ohio, architectural firm, named an application engineer and will handle the development of new product applications for the building trade.

Spencer Chemical Co., Plastics Technical Dept.: Ray Stirrat, formerly a specialist in the Market Research Section of General Electric Co.'s Chemical-Metallurgical Div., named mgr. of the **Sales Service Laboratory** and **Plastics Technical Service.** He replaces **K. A. Kaufmann,** who resigned to accept a position with Amoco Chemicals Corp., Chicago, Ill. **Robert Hughes** appointed mgr. of the nylon technical laboratory and pilot plant at the company's Henderson, Ky., Works. **Charles Imig** has been placed in charge of special laboratory and technical service projects. **John Morris** named a tech. service rep., covering the Midwest, West, and South.

Ray Stirrat

Eagle-Picher Co., Fabricon Products Div.: William B. Clayton, Jr., previously pres. of Cla-Jac Laminated Products, appointed VP in charge of the firm's West Coast operations. **James Pendry,** formerly asst. sales mgr. of Fabricon's Los Angeles plant, now sales mgr. of the Laminated Products Div.

Union Carbide Corp.—Union Carbide Chemicals Co.: Dr. Frank E. Critchfield and **Lloyd H. Wartman** appointed group leaders in the Development Dept. Dr. Critchfield will be in charge of development work on

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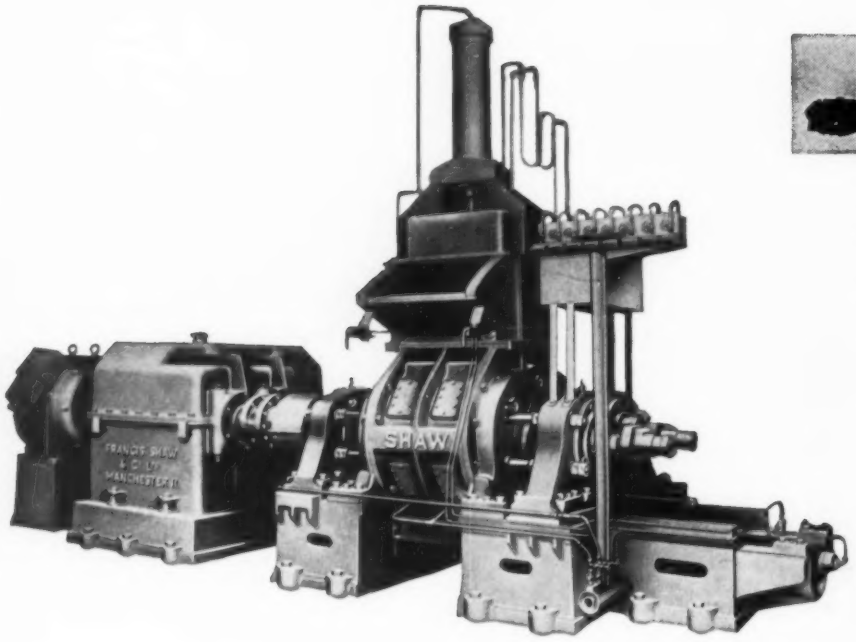

INTERMIX. A robust high efficiency Heavy Duty Internal Mixer for mixing plastic compounds at lower-than-normal temperatures. It is supplied with steam heating for plastics and other materials, and the exclusive rotor design ensures consistent high quality mixing.

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The cost-cutting performance of every Francis Shaw machine and its thorough dependability are the result of long experience and unvaryingly high standards of engineering in every detail of manufacture.

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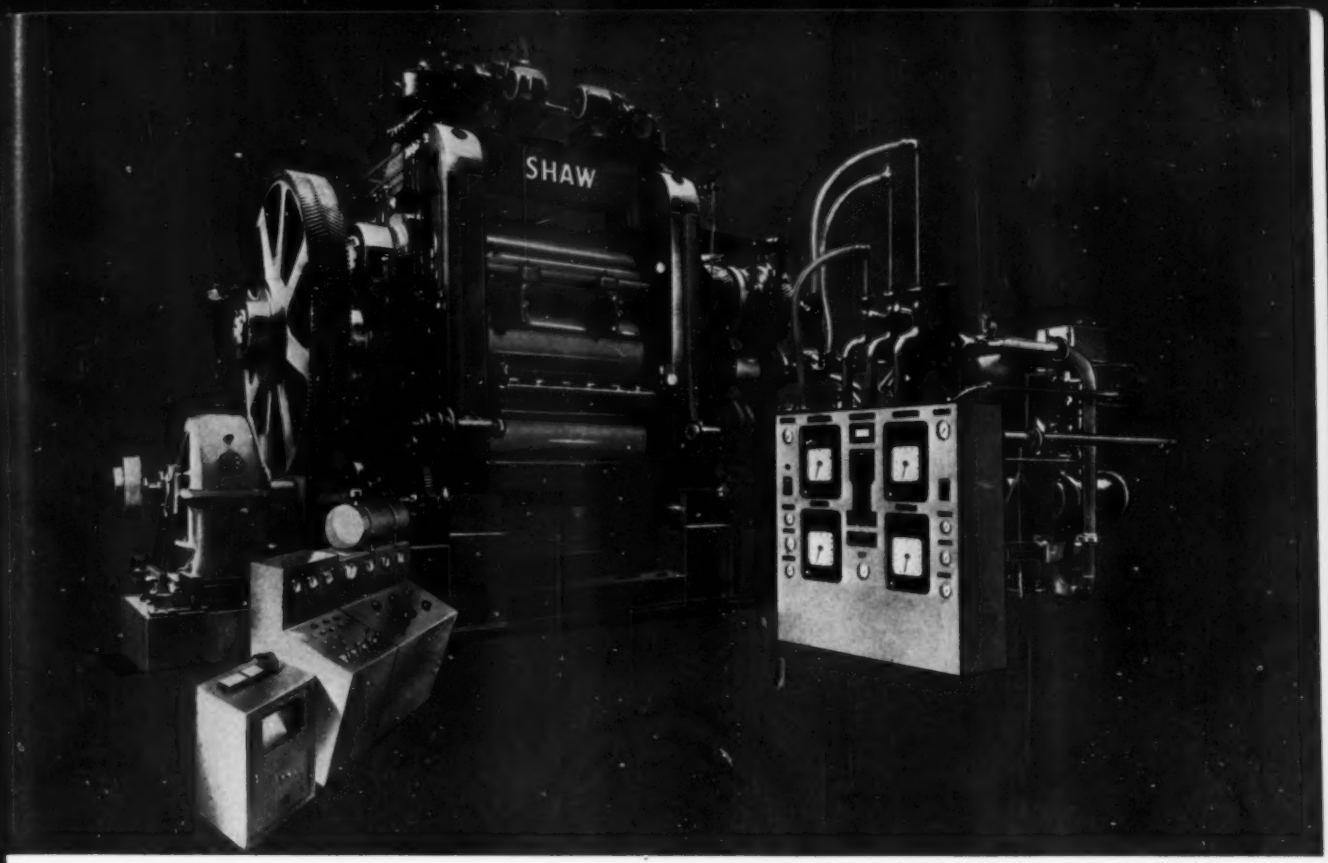
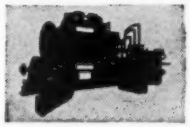
Francis Shaw are available for the design, manufacture, and installation of a wide range of processing equipment





CALENDER. A comprehensive range of Francis Shaw Calenders is available for the processing of all rubber and plastic materials. Flood lubrication and hydraulic roll balancing available on all production sizes. Roll Bending can be fitted as an additional refinement. All sizes available from 13″ x 6″ to 92″ x 32″. Two-, Three- and Four-Bowl Designs.

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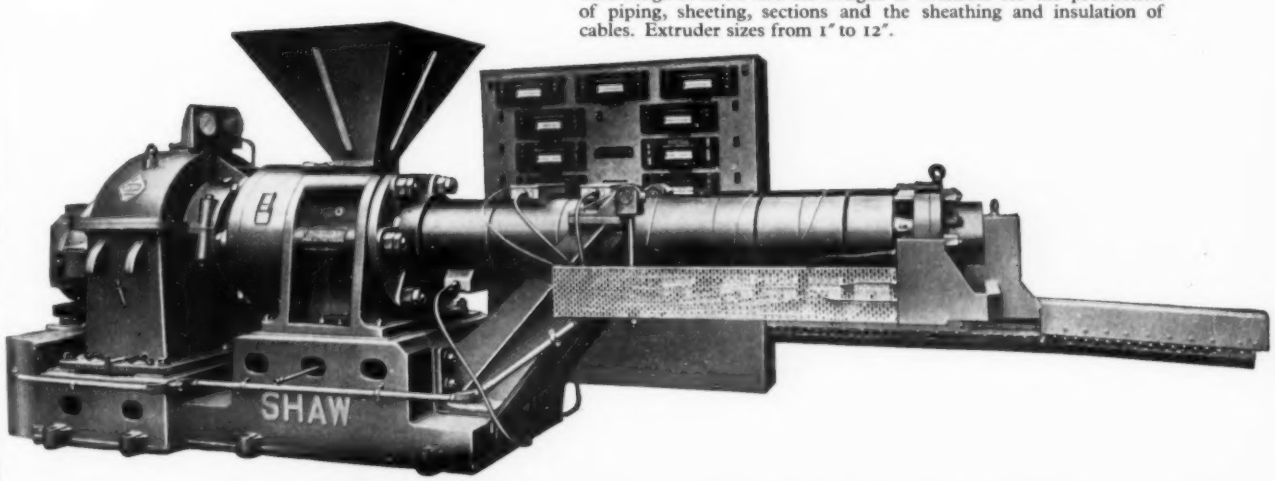
PLASTIC EXTRUDER. Fine temperature control is a vital feature of Francis Shaw extruders. All-electric heating in separate zones is provided, each zone being separately controlled by proportioning instruments. A wide range of screw and die designs is available for the production of piping, sheeting, sections and the sheathing and insulation of cables. Extruder sizes from 1″ to 12″.



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METASAP METALLIC SOAPS

—these proven compounds not only improve internal lubrication of molding powders, but act as plasticizers. When dusted on molds, they supply external lubrication and prevent sticking. They also permit molding at lower pressures, help speed the molding cycle, promote longer mold life, improve the finish of the end product.

* * *

Remember, whatever your needs, you will fill them best—fill them fast—through Metasap. Write for full information. Our Technical Service Department will gladly make recommendations based upon your specific requests. Metasap Chemical Company, Harrison, N.J.

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Companies . . . People

chemical methods of analysis; Mr. Wartman, formerly with Bakelite's Bound Brook, N. J., plant, will supervise product development work on polyolefins.

Bakelite Co.: John F. Mulhern named tech. sales rep. for the Molding Materials Div., operating out of the Cincinnati, Ohio, office.

Visking Co.: Headquarters for the Plastics Div. relocated from Terre Haute, Ind., to 6733 W. 65th St., Chicago, Ill.

Shell Development Co., Emeryville, Calif.: **Dr. N. R. Legge** and **Dr. R. J. Reynolds** named assistant department heads and reearch supvs., respectively, in the Polymer and Chemical Applications Dept. **Marvin A. Deisz** joined the department as a chemist. **Thomas F. Mika** has returned to the company's Emeryville Research Center as asst. department head of the Product Development Dept., after a two-year assignment in the Chemical Sales Div. in New York. **A. De Benedictis** has left the Emeryville Research Center to take a two-year assignment with the Chemical Sales Div. of **Shell Chemical Corp.** in New York.

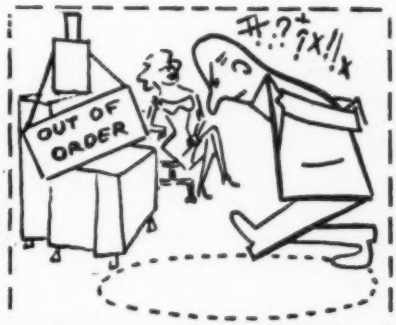
Borg-Warner Corp., Marbon Chemical Div.: William A. Suiter, formerly with St. Regis Paper Co.'s Panelyte Div., appointed sales mgr. for Cycolac, an ABS thermoplastic resin. **D. M. Pratt,** with the firm 24 years, now sales mgr. for Ty-Ply adhesive products, paint resins, and rubber reinforcing resins.

Monsanto Chemical Co — Plastics Div.: Norman L. Hardwicke appointed group leader of the high-pressure polyethylene research group at the division's Research Dept. in Texas City, Texas.

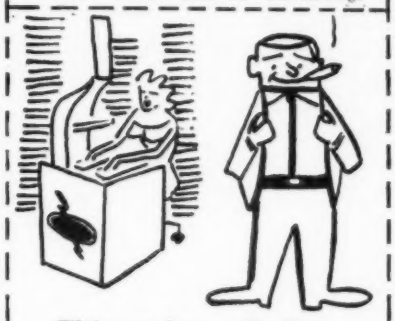
Overseas Div.: William R. Haas, previously dir. of sales, named dir. of marketing to replace **S. C. Finnell, Jr.,** resigned. **Norman E. Horton** succeeds Mr. Haas as dir. of sales. **Robert L. Vincent,** formerly managing dir. of Monsanto Japan Ltd., Tokyo, succeeds Mr. Horton as asst. dir. of sales.

National Container Corp. has become an operating division of **Owens-Illinois Glass Co.** instead of its wholly-owned subsidiary as heretofore. The company will now be known as **Owens-Illinois Paper Products Div.**

Illinois Tool Works, Chicago, Ill.: **Calinoy Div.** established on the West Coast, with office and plant facilities located at 12917 Cerise Ave., Hawthorne, Calif. The division will manufacture plastic and metal fasteners for the missile and aviation industries. It will also operate as the dis-



For over a week, poor Mr. Bleak was told "service will soon be coming."



While over here, at Mr. Meer, Sealomatic keeps his plant humming.

the big difference is

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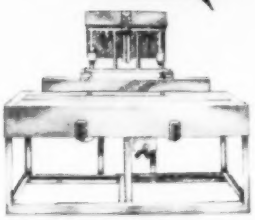
HEAT SEALERS



This unit is specifically designed for long and difficult seals. Uniform pressure can be applied on tables up to 96" long and is available with generators up to 30 KW. Write for Data Sheet P.G.

Whether you're heat sealing card cases or pool liners you'll get dependable, uniform production out of Sealomatic—the one machine built with reserve power—to take the full size die it's rated for and then some. Models from ½KW to 30KW to choose from. Write for helpful brochure.

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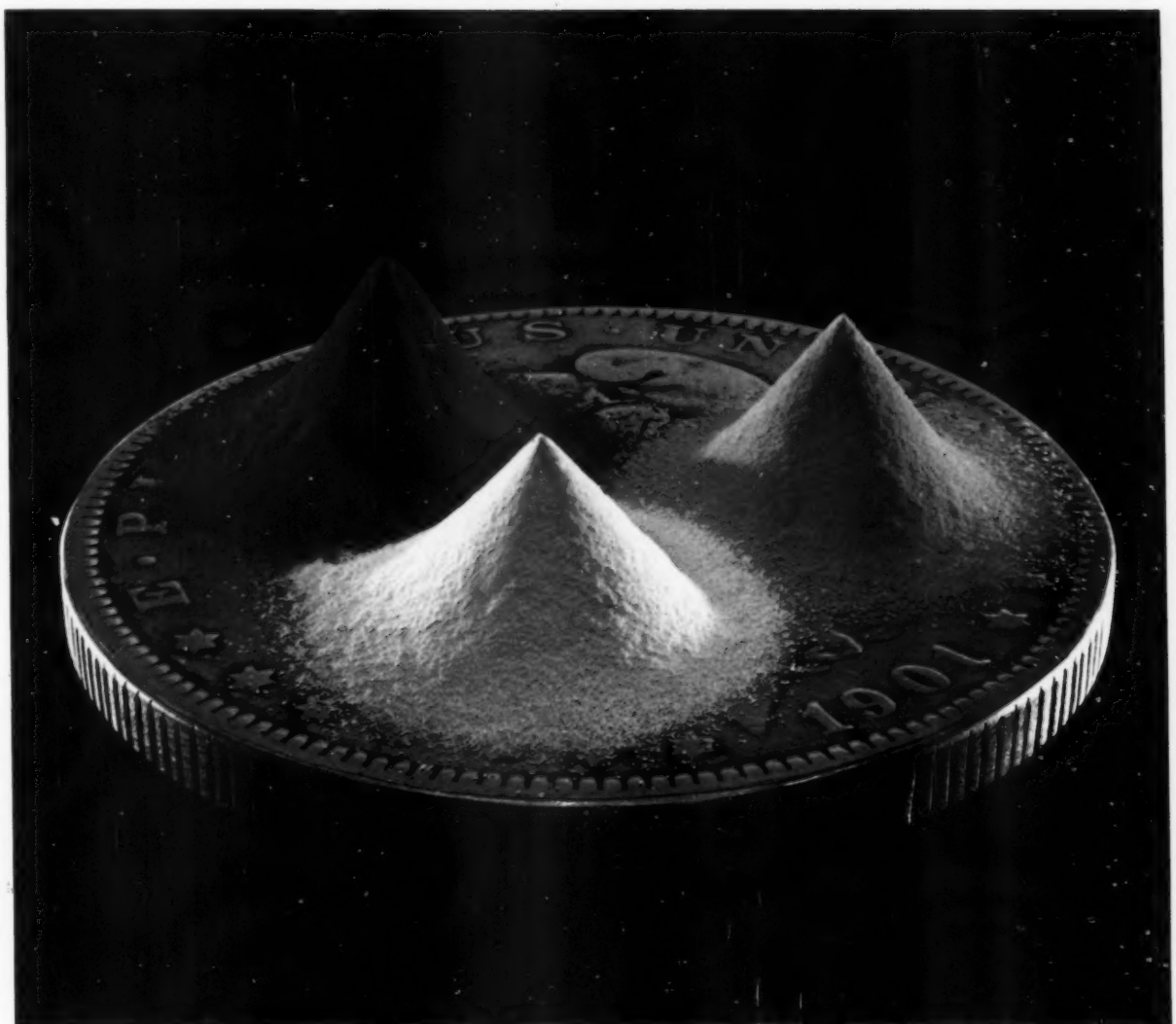

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Profits go up when colors in your plastic products are bright, clean and uniform. For better-looking, faster-selling products, specify Glidden Zopaque titanium dioxide – the whitest white pigment obtainable – plus non-fading, non-bleeding Cadmolith and Mercadmolith colors.

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Chemicals—Pigments—Metals Division
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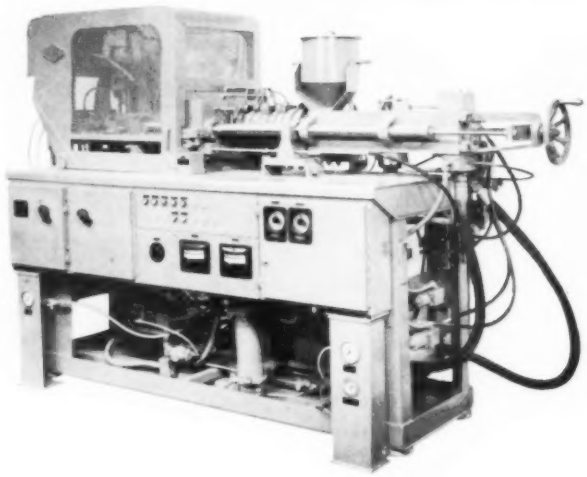
Special Purpose Injection Molding Machine for Containerlike Molding

MODEL

CA30-75

- 30-50 gram capacity
- 30 molding cycles per minute*
- shut-off nozzle for pre-pressurized molding
- simplified mold construction
- built-in die and platen cooling arrangement
- separate injection and clamp hydraulic circuits
- shock mounted control panel
- photo electric recycling monitor
- 75 ton clamp
- 9¼" stroke
- fully automatic

*dependent on material and mold construction



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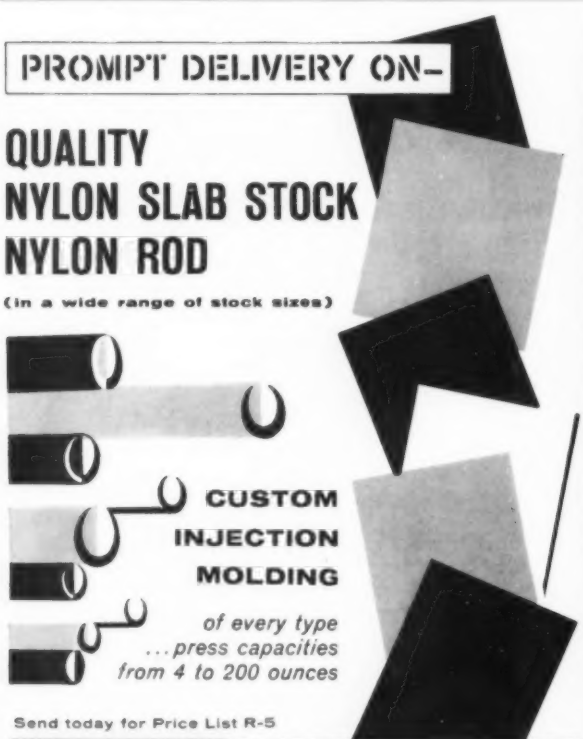

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Preferred and used

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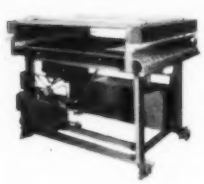

The Goulding Plastic Sheet Glazer produces a lasting lustrous finish comparable to lamination. It vacuum forms more readily than a laminated sheet. Physical properties are not impaired and glazing provides added strength to sheets. Glazing operation is continuous, permitting full output of your extruder thus producing superior products at considerable savings. Custom designed to fit your sheeting line track, the Goulding unit simplifies installation. Specifications, price and delivery on request.

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trict office for the firm's **Shakeproof Div.**, Elgin, Ill., and the **Fastex Div.**, Des Plaines, Ill.

Taylor Fibre Co. has realigned the manufacturing and technical activities of its Vulcanized Fibre Dept., and has placed each under a separate manager. **Kenneth M. Hayes**, previously mgr. of sales promotion and training, named mgr. of manufacturing activities. **John R. Cunningham**, formerly over-all department mgr., to manage technical operations.

Robert M. Prochnow and **Alvin W. Platt** appointed sales engineers in St. Louis, Mo., and San Francisco, Calif., respectively.

Borden Chemical Co.: Charles W. Erickson, formerly merchandising mgr. and dist. sales mgr. of Continental Can Co.'s Plastic Container Div., now New York asst. sales mgr. of the Resinite Dept. **John C. Young**, previously with The Dow Chemical Co., named Ohio tech. sales rep. for the Polyco-Monomer Dept.

Commercial Plastics & Supply Corp., 630 Broadway, New York, N. Y., named distributor by **Polymer Corp.**, Reading, Pa., to service its line of nylon products — sheeting, rod, plate, tubular bars, etc. — in metropolitan New York and part of Connecticut and New Jersey.

Sanford Plastics Corp., custom fabricator of fluorocarbon products, has moved its production facilities from 22 Ravine Dr. to a larger plant on New Brunswick Ave at Charles St., Matawan, N. J. The firm's New York office will continue to be located at 521 Fifth Ave.

American Oil & Supply Co., Newark, N. J., named an agent for the marketing of all grades of A-C polyethylene produced by **Allied Chemical's Semet-Solvay Petrochemical Div.**

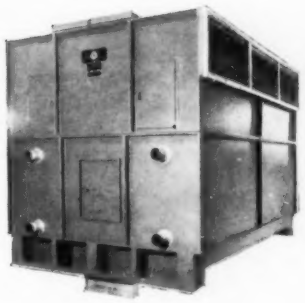
Schwartz Chemical Co. has moved from 326 W. 70th St., New York, N. Y. to 50th Ave. and 2nd St., Long Island City, N. Y.

Marion T. Davis Co., P. O. Box 13042, Station K, Atlanta, Ga., named Southern rep. for agricultural and construction applications of polyethylene film produced by the **Durethene Unit** of **Koppers Co., Inc.**, Pittsburgh, Pa. The firm will offer a complete line of polyethylene film products used in agricultural and construction operations.

Allen E. Polson is the new dir. of sales for **Thompson Chemical Co.**, Pawtucket, R. I., producer of Trulon vinyl chloride resins and Truflex plasticizers. Mr. Polson was formerly

This Self-Contained Fluid Cooling System

...gives most accurate temperature control



Applied in cooling industrial machines or processes to temperatures approaching the ambient wet-bulb, the NIAGARA *Aero* HEAT EXCHANGER is independent of any more than a nominal water supply or disposal. The coolant system is a closed one, free from dirt and maintenance troubles.

Heat is removed from your process *at the rate of input*, giving you precisely the temperature you require and assuring the quality of your product. Heat may be added to prevent freezing in winter or for better control in a warm-up period. Liquids or gases are cooled with equal effectiveness.

Heat is rejected outdoors. Only the little water evaporated on the cooling coils in the air stream, or discharged to prevent hardness build-up, is consumed.

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Joel Frados
EDITOR
MODERN PLASTICS ENCYCLOPEDIA ISSUE

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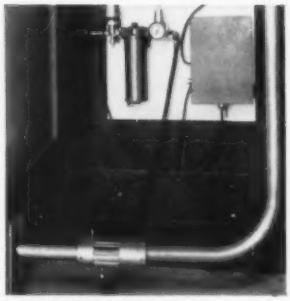

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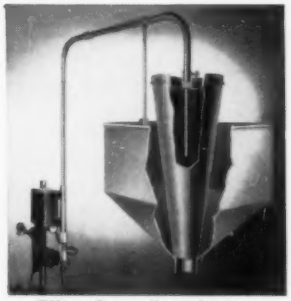

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Automatic - eliminates dust caused when transferring plastic materials.

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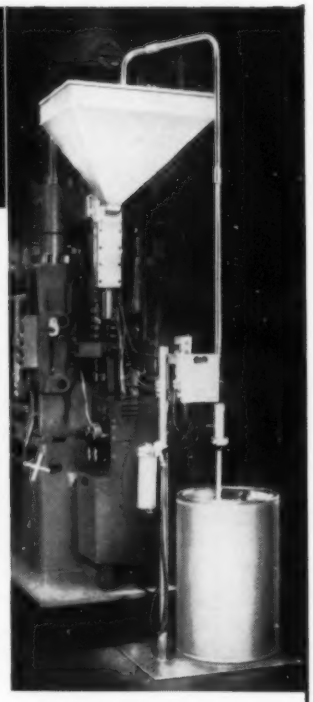


Self Supporting Conveyors
Automatic or manual - capacities to 1,200 lbs. per hour.

Companies ... People

mgr. of resin sales for the Chemical Div. of The Goodyear Tire & Rubber Co.

Charles W. Kleiderer, formerly exec. VP, elected pres. and gen. mgr. of **Penn-Plastics Corp.** and its subsidiary, **Penn-Plastics Mfg. Co.,** Glenside, Pa.

Walter P. Arnold, with the firm 33 years and formerly VP and gen. mgr. of the Wood Preserving Div., elected executive VP of **Koppers Co., Inc.**

Linwood A. Walters, previously mgr. of research and development, named dir. of research and development of **National Vulcanized Fibre Co.,** Wilmington, Del.

Rolland O. Baum, previously exec. VP and gen. mgr., elected pres. of **Tennessee Products & Chemical Corp.,** Nashville, Tenn.

R. S. Earhart, with the company 18 years and previously asst. gen. sales mgr. of the Chemical Div. in Akron, Ohio, named mgr. of **The Goodyear Tire & Rubber Co.'s International Corp. Chemical Div.,** responsible for sales in the foreign countries of the free world. He replaces **R. E. Workman,** who was recently appointed asst. gen. mgr. of the Chemical Div.

John E. Mullen named VP in charge of purchasing and production for **Sheffield Plastics, Inc.,** Sheffield, Mass.

James H. Pax appointed tech. dir. of **Blane Corp.,** Canton, Mass., manufacturer of vinyl insulation compounds and vinyl color concentrates. His former affiliations were with Kaiser Aluminum & Chemical Corp. as a specialist on all phases of wire coating problems and The Goodyear Tire & Rubber Co.

Fred H. Reynolds appointed dir. of market development of **Narmco Resins & Coating Co.,** Costa Mesa, Calif. The firm manufactures adhesives for the aircraft, missile, and industrial fields and related structural plastic materials.

Charles J. McCarthy, formerly sales mgr. of the Custom Molding Div., appointed product sales mgr. in charge of automotive original equipment for **The General Tire & Rubber Co.'s Bolta Products Div.**

Scott Campbell, formerly VP and gen. mgr. of Arvey Corp's Chicago Div., appointed VP and gen. mgr. of **Clad-Rex Corp.,** a subsidiary of **Simoniz Co.,** Chicago, Ill. The company produces permanently bonded laminates of vinyl and metal for use in the building industry and for prefinished material used in cameras, appliances, automobile interior trim, radio, TV, etc.

Urs Brennwald, technical engineer, named exec. VP of **Fjellman American, Inc.,** Joliet, Ill., manufacturer of hydraulic hot plate presses for producing veneer, plywood, and chipboard and presses for producing plastic laminates. Mr. Brennwald will be in charge of sales and will supervise technical and installation problems.

C. Paul Pesek, Jr. has joined **Archer-Daniels-Midland Co.** as adm. asst. for the Resins and Plastics Div.

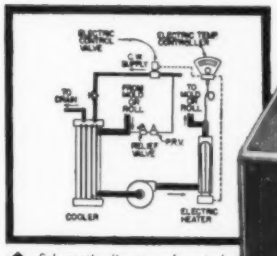
George Ouska, 2152 Palace Ave., St. Paul, Minn., appointed sales rep. in the premium field for **Gries Reproducer Corp.,** New Rochelle, N. Y., and will cover the North Central States. Gries produces small die castings and small molded parts.

Bostrom Corp., Milwaukee, Wis.: **Edwin W. Weiland** named pur. agt. to succeed **J. H. Kitterman,** who has been assigned to special projects in product cost analysis.

The company produces urethane foam cushioning products and standard and suspension seating for trucks, tractors, and earth moving equipment.

Get Automatic Quality Control

...with **SARCOTROL**



▲ Schematic diagram of control circuit in the Sarcotrol Model MC-1, Single Unit. Model MC-2, Dual Unit, is equipped with two of these circuits. Model MC-3 has three complete circuits.

Sarcotrol Model MC-2 Heating and Cooling Unit for injection molds, cylinders, rolls and drums. Fully enclosed. Easily seen, completely accessible control knobs. ▶

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Wheel rides on work— eliminates linkage — According to an important manufacturer of dyeing and printing machines in the textile field, the Surface Speed Indicator assures greater accuracy because it derives its speed directly from the material itself or the surface on which the material is moving instead of by means of mechanical linkages and gears.

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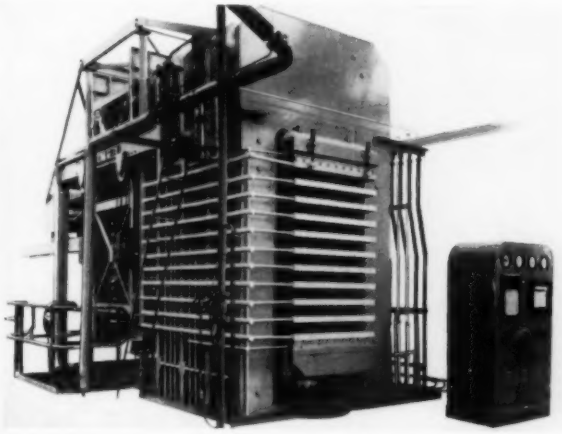

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Wherever costs must be controlled and production increased, Becker & van Hüllen *automatic* laminating presses are called for. Any desired degree of automation is available. This press has automatic loading, unloading and sheet handling. How much automation do you need?

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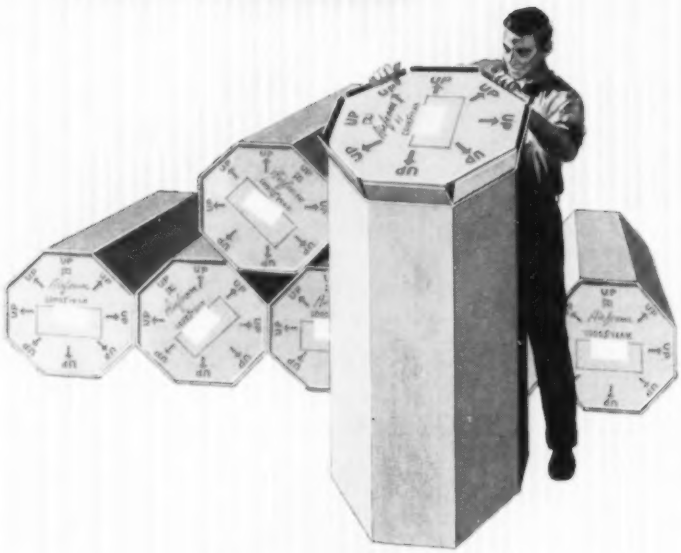

This H & D corrugated drum makes rolls of Goodyear Airfoam easier to pack, more economical to ship. Flexible ends provide protection against compression and shock. Packaging problem? Better see H & D.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946, of MODERN PLASTICS, published monthly at Bristol, Connecticut, for October 1, 1958.

State of New York

ss.

County of New York

Before me, Notary Public in and for the State and County aforesaid, personally appeared Alan S. Cole, who having been duly sworn according to law, deposes and says that he is the Publisher of MODERN PLASTICS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), to wit:

1. The names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, Alan S. Cole, 575 Madison Ave., New York City.

Editor, Hiram McCann, 575 Madison Ave., New York City.

Managing editor, A. Paul Peck, 575 Madison Ave., New York City.

Business manager, Stuart Siegel, 31 Tintern Lane, Scarsdale, N. Y.

2. The owner is: (if owned by a corporation, its name and address must be stated and also, immediately thereunder the names and addresses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as those of each individual member, must be given.)

Breskin Publications, Inc., 575 Madison Ave., New York, N. Y.

Charles A. Breskin, 575 Madison Ave., New York, N. Y.

Millie Breskin, 59 Park Road, Scarsdale, N. Y.

Linda Klein, 318 Northern Blvd., Albany, N. Y.

Millie Breskin and Stuart Siegel as Trustees, 59 Park Road, Scarsdale, N. Y., 31 Tintern Lane, Scarsdale, N. Y.

S. M. Moisseiff, 860 Fifth Ave., New York, N. Y.

E. S. Gregg, 111 Eighth Ave., New York, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding one percent or more total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation acting as such trustees; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

ALAN S. COLE, Publisher

Sworn to and subscribed before me this 28th day of August, 1958.

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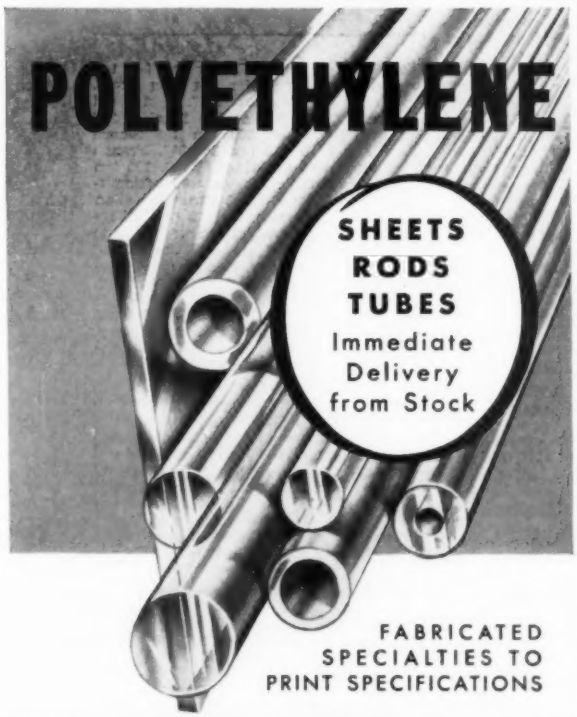
3600 WEST PRATT BOULEVARD • CHICAGO 45, ILLINOIS • U.S.A.

CHICAGO, CORNELIA 7-3000; • LONG DISTANCE, LINCOLNWOOD, ILLINOIS, ORCHARD 5-9400 • WESTERN UNION FAX

POLYETHYLENE



FABRICATED SPECIALTIES TO PRINT SPECIFICATIONS

COLONIAL KOLONITE CO.

2232 W. ARMITAGE AVE. • CHICAGO 47, ILL.

12300 W. ADLER LANE • MILWAUKEE 13, WIS.

INTERPLASTICS NEWS LETTER

POLYETHYLENE: We are now selling linear Polyethylene with a density of .965 for a variety of uses. Some of our customers are buying our natural linear Polyethylene to mix in with conventional low density Polyethylene in order to increase stiffness. For some customers we compound mixtures to their specifications.

We make colored linear Polyethylene and colored mixtures of different densities, tailored to our customer's requirements. Not only can our customers obtain the desired stiffness this way, they also can cut down on material cost.

If you are cost conscious, and who isn't these days, be sure to check with us also on prices for natural conventional Polyethylene, either virgin or reprocessed. We always carry large stocks and guarantee the quality of what we sell.

POLYSTYRENE: We are now compounding Polystyrene into special colors and special effects such as mother-of-pearl, phosphorescent and tinsel flake. Your special color requirements in Polystyrene can be filled by us quickly and accurately.

We can offer for immediate sale a specially priced spot lot of 50,000 lbs. of virgin crystal Polystyrene.

NYLON: At present, we can offer reprocessed Nylon in pellets, black or in colors @ 65¢ per lb. This is furnished dried and packed in 25 lb. metal cans.

We can also offer reground Nylon scrap in natural, pink, blue and green.

VINYL: We make Vinyl compounds based on virgin resin only; whether for extrusion or injection molding, we can tailormake the right compound for you. Because our compounding plant uses their own resin at mill cost, our prices for compounds are less. Vinyl Resin: We distribute both domestic and imported resin, both straight PVC and copolymer. We can offer a large variety of resins at good prices.

OTHER MATERIALS: Our business is the distribution and marketing of thermoplastic molding powders, both on a continuous supply and on a spot basis. Keep us informed of your requirements, and we will keep you posted with good offerings. Also, offer us your surplus materials. We are always in the market to buy.

REMEMBER:

"Our ONLY function is to save you money."

INTERPLASTICS CORPORATION

120 EAST 56th STREET, NEW YORK 22, N. Y., U. S. A.

TEL: PLAZA 1-4280 CABLE ADDRESS: INPLAKO

Classified Advertisements

EMPLOYMENT • BUSINESS OPPORTUNITIES • USED OR RESALE EQUIPMENT

Machinery and Equipment for sale

FOR SALE: 2 oz. Van Dorn semi auto. 4 oz. Lewis, 1954—$3,000. 4/6 oz. R-P, 1955. 4 oz. vert. DeMattia. 8 oz. R-P, 1946—$5,000. 12 oz. W-S Model E—$6,000. 12 oz. Lester w/solid frame—$4,000. 16 oz. vert. Impco. 48 oz. W-S 1950. Ovens, grinders, powder mixers, injection molding machines 1 oz. to 60 ozs. never used and used. Acme Machinery & Mfg. Co., Inc. 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900. 102 Grove Street, Worcester, Mass. PLeasant 7-7747. 5222 W. North Ave., Chicago, Illinois, TUxedo 9-1328.

FOR SALE: 4 compression molding presses, 470, 200, 100 and 50 tons; 1 Porter 33 cu. ft. stainless steel ribbon blender; 3 Day 75 gal. jacketed double arm mixers, spiral blades; 1 NRM 2-½" oil heated plastics extruder; 2 Cumberland plastic granulators No. 0, No. ½; also chopper, mills, mixers, etc. Chemical & Process Machinery Corp., 52 9th Street, Brooklyn 15, New York, Phone HY 9-7200.

FOR SALE: 3-750 gal. stainless reactors. 11-baker-perkins 200 gal. sigma blade mixers. Pfaudler glass-lined reactors: 750, 500, 300, 100, 30 gal. Farrel-Birmingham 1500 HP horiz. reducer, 5:1 ratio. Ribbon mixers 336, 200, 75 cu. ft. Stokes tablet or preform presses, rotary cutters, mills, etc. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: Rotational molding machine. Brand new. Made by Akron Pressform. Six station used only for samples. Can be seen in operation. Special low price. Missouri Wood Heel Company. 4067 Folsom Avenue, St. Louis 10, Missouri, Mo 4-5100.

FOR SALE: One 30 oz. H.P.M. press with 200 tons maximum clamp. Platens 36"x36"x16" downward travel. Delivers 15 oz. from each side cylinder. Semi automatic with all electrical controls and 2 gump automatic weigh scales, complete $9000.00. Amphenol Electronics Corporation, 6235 S. Harlem Ave., Chicago 38, Illinois.

FOR SALE: Injection molding presses 1—Reed 10 D 8 oz. 1953 with spare parts 1—Impco 2-3 oz. Fully automatic hi speed 1955. Both machines in excellent condition. May be seen in operation. North American Plastic Corp. 550 Hartrey Ave., Evanston, Illinois.

16-oz. INJECTION MOLDER H.P.M.—LATE: With Wheelco and Guardsman controls. Very low price. 4 Plastic Scrap Grinders in stock, hydraulic presses, pumps and vacuum impregnator. Abbott Machinery Company, 117-123 Peter Street, Union City, N.J. Phone: UNion 5-1700.

FOR SALE: 10 HP foremost plastic scrap granulator. Practically brand new. Extra set of knives and screens included. 4½" Hartig Extruder, extra long barrel, 50 HP vs vari drive, year and a half old. Both units can be seen in operation. Reply Box 4013, Modern Plastics.

FOR SALE: Injection molders: 1 oz. & 2 oz. Van Dorn; 8 oz. Reed-Prentice double link 9 oz. H.P.M. Extruders; 16 oz. Reed-Prentice with 3 Wheelco Controls Hartig 3¼" elect. htd. with reliance drive NRM 1½" wire coating line, complete. New extruders, JMC 1½" to 6" sizes, 21:1 ratio, variable speed drives. Hydraulic molding presses: 300 ton Lake Erie, 36" x 36" platen, self contained; Stokes 50, 100, 150, 200, 300 ton presses, bar controls. Transfer presses: Dunning & Boschert 150 ton to 400 ton; Lake Erie 200 ton and 300 ton. Tablet presses: Stokes model R, model T, model 280-G, model DDS-2; Defiance model #45; Colton model 5-T. Scrap cutters: Ball & Jewell Nos. 2, 1½, 1, ½; Robinson 10 hp, MD. 2-roll plastic mills: new JMC 6" x 13" Lab Mill, self contained, 7½ hp drive, 4" bearings. Write for brochure. Johnson Machinery Co. 683-R Frelinghuysen Ave., Newark, New Jersey. BIgelow 8-2500.

FOR SALE: One 1951 model 16 oz. Watson-Stillman 385 ton plus injection machine. 47½ horse power. Fast cycle. Now running. First-class condition. Price, photographs, spare parts list available on request. Reply Box 4027, Modern Plastics.

JUST SECURED: Most Modern Packaging and processing machinery. Equipment installed within last 2 years. Available at great savings. 4—Hayssen model F compaks with net weight scales, bulk and dribble feeds, electric eyes. 4—Ceco model 40-9½-GG automatic adjustable cartoning units. Also model TT. 1—Pneumatic Scale automatic carton feeder, bottom sealer and top sealer with interconnecting conveyors. 6—Fitzpatrick model D-6 Stainless steel comminuters. 4—Day size G. 1500 lb. Ribbon type powder mixers. 2—Rietz disintegrators model RD18 complete with 50 HP motors. 1—Enterprise Foundry Disintegrators model EVM3 complete with 50 HP motors. Complete details and quotations promptly submitted. Union Standard Equipment Company, 318-322 Lafayette St., New York 12, N. Y., Phone: CAnal 6-5334.

INJECTION MOLDING MACHINE FOR SALE: One Watson Stillman 16 ounce machine, purchased new in 1953. May be seen in perfect operating condition. For immediate delivery. Reply Box 4008, Modern Plastics.

FOR SALE: 1000 ton and 2000 ton hydraulic presses—1 oz. model H-200 Van Dorn injection machine—3 oz. Fellows, 8 and 12 oz. Lesters, 50 oz. Impco,—400 ton 36"x36" vertical presses—No. ½ and 1½ Ball and Jewell grinders—Carver laboratory presses and others to 75 ton—6"x13" laboratory mills—Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N.J., phone DE 4-1615—Cable address Plasmex-Boonton.

FOR SALE: 64 oz. Injection Molder with Pre-Plasticizer mold size 32"x50" 750 ton clamp. Lester 8 oz. Model 2½ L (1949). DeMattia 12 oz. (1946). DeMattia 4 oz. H.P.M. Rubber Injection molders, 21½" x28" mold space, steam heated platens. Watson-Stillman 300 ton semi-automatic compression molding press (1947) self-contained, mold size 34"x27". Watson-Stillman 250 ton 28"x24". Watson-Stillman 140 ton 22"x16". Waterbury Farrel 85 ton 20"x24". W.F. 63 ton 15"x15". Laboratory presses—15 ton 10"x8" and 10 ton 6"x6" platens. (2) 8 ounce Reed Prentice injection molding machines and (1) 8 ounce Lester Phoenix (late) with nylon attachment. Scrap cutters, valves, accumulators. Hydraulic Presses—all sizes. Aaron Machinery Co. Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

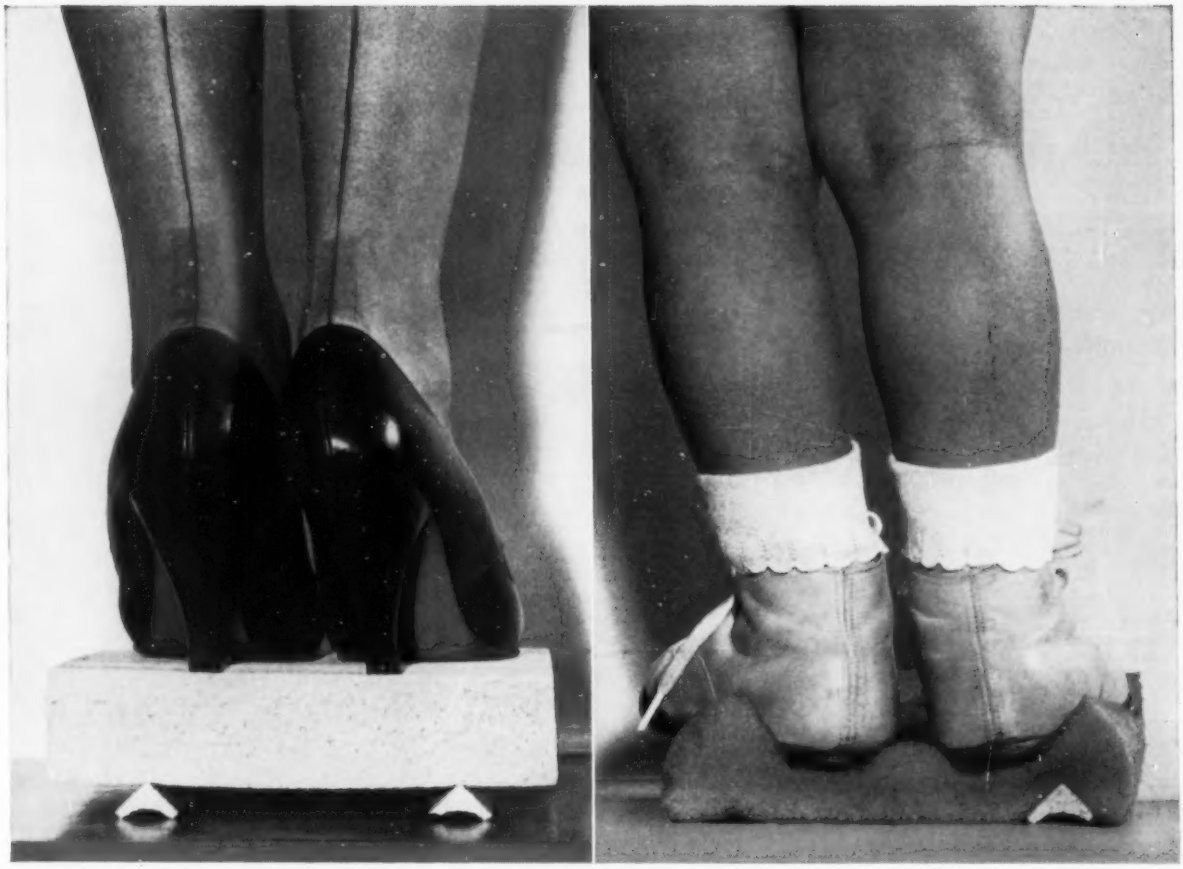
FOR SALE: 1 Baker Perkins 15USE, 100 gal. all stainless double arm Vacuum mixer; 1—Baker Perkins size 15VUUM, 100 gal. double arm mixer, 100 HP motor; 1—Baker Perkins size JNM 100 gal. double arm mixer; 6—Day 250 and 100 gal. double arm mixers; 1—Ball & Jewell #1 Rotary Cutter; 2—Two Roll Mills 6" x 12"; 6—Stokes model DD2, DS3, D3 and B2 Rotary Preform presses; 4—Stokes model "R" single punch Preform presses; Also: Sifters, Banbury mixers, Powder mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

FOR SALE: Baldwin-Southwark 200 ton semi-automatic transfer molding press. 2500 ton downstroke 54" 102". French Oil 250 ton 38"x28". Elmes 200 28"x26". 200 ton hobbing press. 200 ton 16" record presses. D & B 140 ton 36"x36". French Oil 120 ton self-contained. W. S. 120 ton 24"x24". Hydraulic pumps and accumulators. Van Dorn 1 and 2 ounce injection machines. Other sizes to 100 oz. Baker-Perkins and Day jacketed mixers. Plastic cutters. Oxford 57" slitter. Seco 6"x13" and 8"x16" mills and calenders. Adamson 6" rubber extruder. Oil and Elect. Plastic extruders, lab to 6". Single & Rotary preform press ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Co., 107—8th St., Brooklyn 15, N.Y.

LIQUIDATION SALE: molding plant: (2)—325 ton French Oil compression presses. (1)—300 ton Erie compression press. (2)—170 ton transfer presses. (1)—100 ton compression press. (3)—75 ton transfer presses. (1)—No. 5½ T Colton preform machine. (1)—3 DT Colton tablet machine. Reply Box 4025, Modern Plastics.

FOR SALE: (6) 100 ton, 10" ram, 10" stroke @ $1250; (7) 200 ton, 9" stroke, 14" ram, 36x36, @ $2160; (6) 200 ton, 9" stroke, 15" ram, 30x30 @ $1850; (1) ton complete, 18x18 @ $1850; (1) 200 ton 16" ram 30x30 @ $2460; (2) 200 ton 16" ram, 42x42 @ $2850; (1) 200 ton, 15" ram, 42x42 @ $2600; (3) 250 ton (2) 12" ram, 30x60 rebuilt @ $3675. Hydraulic Sal-Press Co., Inc., 386-90 Warren Street, Bklyn., N.Y.

(Continued on page 252)



RIGID OR RESILIENT—With slight changes in formulations, vinyl foam in a wide range of hardness is possible with Du Pont BL-353 Blowing Agent.

Make VINYL FOAM in a wide range of properties with Du Pont BL-353 Blowing Agent

Multiple Uses • Du Pont's general-purpose chemical blowing agent BL-353 releases nitrogen at a uniform rate when heated to form either vinyl foam or cellular vinyl. There is no end to what you can do with it.

BL-353 for instance, makes foam for cushions, fish net floats, sheet material, semi-rigid foam shoe soles, boat fenders or children's toys, to name the uses shown above.

Variable Hardness and Density • With only slight variations in the formulations and processing conditions expanded vinyl can be obtained in a wide range of physical properties—from rigid to soft and resilient and in densities from 2.5 to 35 lbs./cu. ft.

Make It Thick or Thin • You can easily get thick or thin slabs of vinyl foam by fusing and curing with dielectric heat. Make it in thin sheets or in slabs up to 6″ thick.

Variety of Colors Possible • You can make your foam in any color you want including snowy white because Du Pont BL-353 imparts no color to the resin. It won't affect odor either.

Make Both Vinyl Foam and Cellular Vinyl • With Du Pont BL-353 you can make either vinyl foam (with interconnected cells) or cellular vinyl (non-interconnected cells). Either way you get fine, uniform, cell structure throughout the sponge.

Available in Commercial Quantities • Write for more information and ask for a sample of Du Pont BL-353 for your own product testing. You can get it in commercial quantities when you need it. Write to E. I. du Pont de Nemours & Co. (Inc.), Chemical Sales, Explosives Dept. MP10-2543 Nemours Building, Wilmington 98, Delaware.

DU PONT

DU PONT BL-353

CHEMICAL BLOWING AGENT

Better Things for Better Living . . . *through Chemistry*

(Continued from page 250)

GOOD EQUIPMENT: At the right price. Falcon ribbon blenders in steel or stainless; NRM 2½" extruder, rotary cutters by Ball & Jewell, Sprout-Waldron, Abbe; Baker Perkins heavy duty dbl. arm mixers, 100, 200, 300 gal; French Oil Mill Hydr. press 450 tons; Blaw Knox S/S Resin Kettle 7'6"/7'6", Jktd. Agtd.: Sturtevant 300 cu. ft. Batch Mixer; Stokes and Colton Rotary and Single Pre-form Presses; Send for new First Facts, containing complete illustrated inventory; First Machinery Corp., 209 Tenth St., Bklyn 15, N.Y. Fred R. Firstenberg, Pres.

Machinery wanted

WANTED: 32 oz. or larger injection moulding machine—Reed Prentice, H.P.M., Leicester. State age, condition and full particulars. Reply Box 4018, Modern Plastics.

WANTED: 2-4 oz. Moslo injection molding machines. State model and serial no. and price. Rego Insulated Wire Co., Hoboken, N.J.

WANTED: Embossing Rolls for artificial leather. Maximum diameter: 11 inches; Minimum length: 36 inches. Leather grains and small novelty patterns. Reply Box 4014, Modern Plastics.

UPRIGHT INJECTION MOLDING MACHINE: Wanted, capacity 8 oz. or less. State capacity, age and price. Hechler Bros. Inc., 22-19 37th Avenue, Long Island City 1, N.Y.

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N. Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass., PLeasant 7-7747, 5222 West North St., Chicago, Illinois, TUxedo 9-1328.

Materials for sale

FOR SALE: 30,000 lbs. virgin natural medium impact styrene. 20,000 lbs. virgin pastel shades hi impact styrene. 25,000 lbs. virgin natural polyethylene. Also standard toy colors polyethylene. Low prices. Reply Box 4029, Modern Plastics.

FOR SALE: 800 tempered glass plates, ¼" x 36" x 48". Used and new. Available at low price. Reply Box 4020, Modern Plastics.

REPROCESSED NYLON FOR SALE: Reprocessor offers highest quality pelletized nylon in all common resin types. Natural and black available from stock. Custom colors compounded on request. Samples and quotations promptly furnished. Adell Plastics Inc., 5208 Eleanora Ave., Baltimore 15, Md.

VIRGIN STYRENE FOR SALE: Cut-Costs—We offer 500,000# Virgin Styrene High Impact Styrene in natural, all standard colors, and most spec. colors. Med. Impact Styrene in natural, all standard colors, and most spec. colors. Gen Purpose Styrene in crystal, all standard colors, and most spec. colors. Write us for our low price quotations. We will match your color requirements. Our compounding plant and warehouse is located in Erie, Pa. and deliveries are made in our own trucks. Call, wire, or write Erie Plastics Co., P.O. Box 1068, Erie, Pa., Phone 22-503.

UTILITY BLACK HI IMPACT POLYSTYRENE: 200,000 pounds Utility Black Hi Impact Polystyrene. Samples available. Reply Box 4001, Modern Plastics.

FOR SALE: 30,000 feet virgin silicone tubing in long lengths. ⅛" I.D. 3/64" Wall. Make offer. Reply Box 4003, Modern Plastics.

Materials wanted

POLYETHYLENE SCRAP WANTED: Film, lumps, rejects, reground and surplus lots. Top prices paid. M. Koenig & Sons, Inc., 758 Humboldt Street, Brooklyn 22, N.Y. Telephone: EVergreen 9-1800.

PLASTIC SCRAP WANTED: From molders, vacuum formers, fabricators; acrylic, styrene, polyethylene, acetate, butyrate, etc. For top prices write, wire, phone collect. Philip Shuman & Sons, 15-33 Goethe St., Buffalo 6, N. Y. Tel: HUmboldt 1811.

WANTED: Plastic scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 514 West 24th Street, New York 11, N. Y.

NYLON SCRAP WANTED: By reprocessor. All kinds including molding, extrusion and fabricating. Quotations promptly furnished on all grades and polymer types. Adell Plastics, Inc., 5208 Eleanora Avenue, Baltimore 15, Md.

WANTED: Plastic of all kinds—virgin, reground, lumps sheet and reject parts. Highest prices paid for styrene, polyethylene, acetate, nylon, vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y., RAvenswood 1-0880.

WANTED: Vacuum formed and molding scrap: Any Kind—Any Quantity. Contact us for latest quotations. Claude P. Bamberger, Inc. One Mount Vernon Street, Ridgefield Park, N.J. Telephone: HUbbard 9-5330.

Molds for sale

FOR SALE: Almost new steel injection mold, single cavity, six ounce capacity for producing unique patented housewares, gift item not at present on market. Exclusive patent rights available. Excellent for demonstration, mail order or premium. Reply Box 4010, Modern Plastics.

Molds wanted

WANTED: Injection molds for 20 gallon garbage can and cover. Reply Box 4009, Modern Plastics.

WANTED: Injection molds for watch boxes (hinged), also ring boxes. State price, technical data and enclose samples. Reply Box 4019, Modern Plastics.

TOY MOLDS WANTED: Send basic information. Submit samples if available. Reply Box 4024, Modern Plastics.

(Continued on page 256)

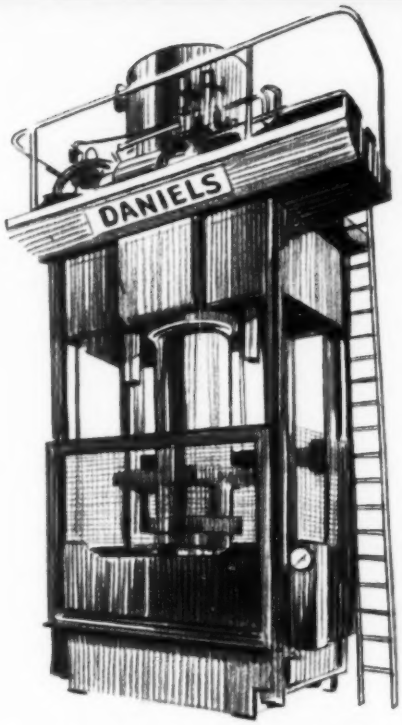
PLASTICS—GERMANY

Important distributors (organic and inorganic chemicals) with numerous branches and warehouses in all parts of the Federal Republic of Germany, disposing of excellent business connections throughout Europe, desire sole-agency for Germany and possibly other European countries.

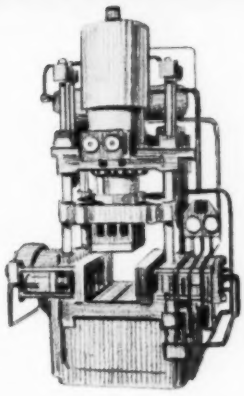
MANUFACTURERS OF PLASTIC RAW MATERIALS and PLASTIC SEMI-FINISHED GOODS please write to:

Box 4023, MODERN PLASTICS

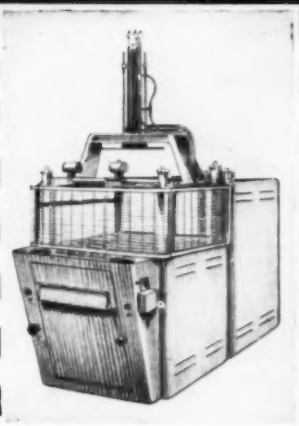
PLANT FOR PLASTICS?



250-ton low-pressure press for reinforced plastics. Fitted Vickers pumping unit and 8 ft. x 5 ft. water-cooled tables.

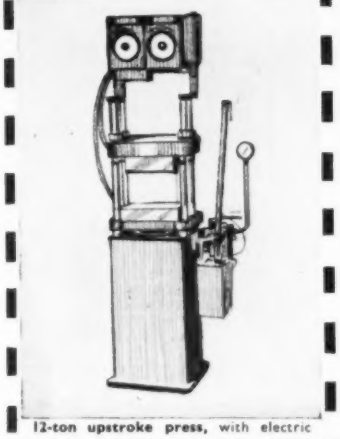


100/60-ton side-ram press. Platen sizes: top, 12 in. x 20 in.; bottom, 21 in. x 20 in.

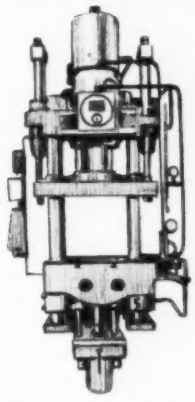


30/30 RPD vacuum forming machine, for 30" sq. sht., with rising drape, top plug assistance, bubble forming equipment, etc.

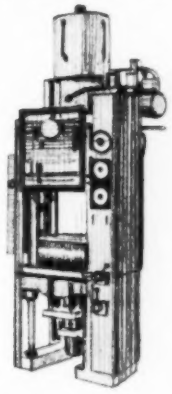
Platens for steam and electric heating. Hydraulically tested to 500 lb/sq. in.



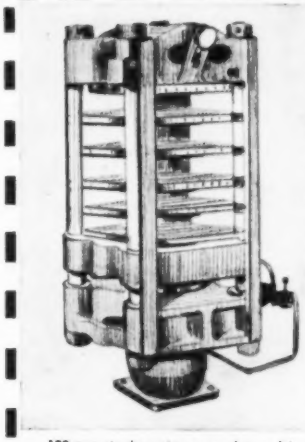
12-ton upstroke press, with electric platens, thermostats and handpump. Works up to 19 tons.



250-ton transfer press, fitted with automatic timing, delay valve, prefiller valve and ejection unit.



50/75-ton transfer press, fitted with automatic timing. 8 in. diam. main ram has 16 in. stroke.



150-ton single-acting upstroke, multi-daylight press, with steam-heated platens.

T. H. & J. DANIELS LIMITED

Lightpill Iron Works, Stroud, Glos., England

Cables: Telex 43-320 Daniels Stroud England

(Continued from page 252)

Help wanted

EXPANSION CREATES OPENING FOR EXPERIENCED RUBBER AND PLASTICS ENGINEER: As a major manufacturer of electronic and electro-mechanical devices we are planning considerable acceleration of our activities in both rubber and plastics compounding on a laboratory, pilot production and production basis. If you have a bachelor's degree, or, preferably an advanced degree, in Chemistry or Chemical Engineering, and can point to a satisfactory experience record, you will find much to interest you here. This is a critical, responsible position which requires 8 to 20 years of experience, a portion of which, at least, should include activity in rubber and plastic compounding. Your record should denote a broad interest that ranges from the research aspect to production supervision and control. Basically, your background should qualify you to help us obtain specific material characteristics which are not ordinarily available through commercial sources and to maintain highly exacting controls on material characteristics. Salary commensurate with ability. Relocation expenses paid. Numerous company benefits. U. S. citizenship required. Plant is adjacent to fine, new residential area of a moderate-size midwestern city. Numerous modern, highly-rated schools. Favorable climate, many cultural and recreational facilities contribute to pleasant living. Company offers assistance program for engineers who desire advanced study at local universities. Your inquiry strictly confidential. Airmail resume at once. Reply Box 4022, Modern Plastics.

VINYL EXTRUSION FOREMAN: Experienced in profile & sheet extrusion, must be familiar with machine set-up & die design. Only those well qualified in P.V.C. extrusion need apply. Location in B'klyn, N.Y. All replies held in strictest confidence. Reply Box 4021, Modern Plastics.

FILL YOUR LINE: Representatives established foam styrene molder located Midwest seeks qualified custom molding sales agents describe area served and lines carried. Reply Box 4011, Modern Plastics.

PLASTIC ENGINEER: Excellent opportunity for a qualified man to become associated with injection molding plant located in beautiful Shenandoah Valley. We manufacture well-established line of proprietary plastic products. Due to our expansion, we need a man to assist in mold design, estimate mold cost, price parts, and follow the job through molding and finishing of parts. Position offers unlimited opportunity for advancement. Salary commensurate with experience. Send complete resume to Hake Manufacturing Company, Inc., P. O. Box 322, Roanoke, Virginia.

SALES REPRESENTATIVE: Wanted by Custom Injection Molding Company. We are interested only in men of proven ability, who are now calling on Industrial accounts. We are located in Eastern Ohio with modern and up-to-date facilities. Desirable territories open—commission basis. Reply giving territory wanted. Reply Box 4030, Modern Plastics.

REPRESENTATIVE DESIRED: Custom injection molder with complete facilities desires representation New England and New York areas, twenty years expanding molding activity now multi-million dollar operation. Want man who will actively seek customers, who will make use of our facilities to obtain, develop accounts. Unexcelled opportunity. Submit complete resume. Reply Box 4007, Modern Plastics.

EXTRUSION ENGINEER: AA-1 Chicagoland manufacturer offers unusual opportunity to plastic extrusion specialist capable of assuming full manufacturing responsibility for new extrusion division. We need a man capable of building our extrusion division from scratch, including the purchase of equipment. Experience in polyvinyl-chloride would be most helpful. State complete facts, including age, education, experience and references. Liberal compensation for qualified man. Our employees know of this ad. All replies will be held in strict confidence. Reply Box 4006, Modern Plastics.

WANTED: Chemist or Production man experienced in the manufacture and development of Urea and Melamine-Formaldehyde resins for coatings and molding powders. The man we want must be capable of producing and selling these products to the paint and plastics industry. Excellent opportunity for the right man on a profit sharing plan. Location metropolitan New York. Full information in strictest confidence. Reply Box 4002, Modern Plastics.

PLASTICS COMMERCIAL DEVELOPMENT: Top quality men to help rapidly growing strongly research minded company establish a sound position in thermoplastics. Minimum of B.S. and five years experience, preferably with polyolefins and or styrene. Work will entail market research and all aspects of field development so familiarity with consuming industries essential. Submit detailed resume including education, experience and salary requirements. Reply Box 4000, Modern Plastics.

SALES AGENT WANTED: For liquid chillers required and used by molders, extruders, embossers and vacuum formers. Exclusive territories now open. Write full particulars. Reply Box 4028, Modern Plastics.

PERSONNEL: Executive—Technical—Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 220 South State, Chicago 4, Ill.—WAbash 2-4800. Call, write or wire—in confidence.

Situations wanted

MANUFACTURERS REPRESENTATIVE: Experienced agent with excellent background in plastics wishes to represent progressive concern in the Detroit area. At present calling on automotive and other industrial accounts. Reply Box 4004, Modern Plastics.

SALES-PRODUCTION ENGINEER: Married, 35 years of age, 15 years experience in molding, fabricating, and decorating of plastics, design and manufacture of machinery and production tools related to packaging. Experienced in new product design and model making. Willing to invest a small amount of capital. Can relocate. Reply Box 4031, Modern Plastics.

EXTRUSION AND BOTTLE BLOWING: 8½ years production experience including extrusion blow molding, polyethylene film, all types of pipe, and shapes. Have designed extrusion dies and set up various extrusion lines. Am currently production superintendent of a plant primarily in plastic bottles. Can supply excellent references. 32 years old, family. Chemical Eng. Degree. Reply Box 4005, Modern Plastics.

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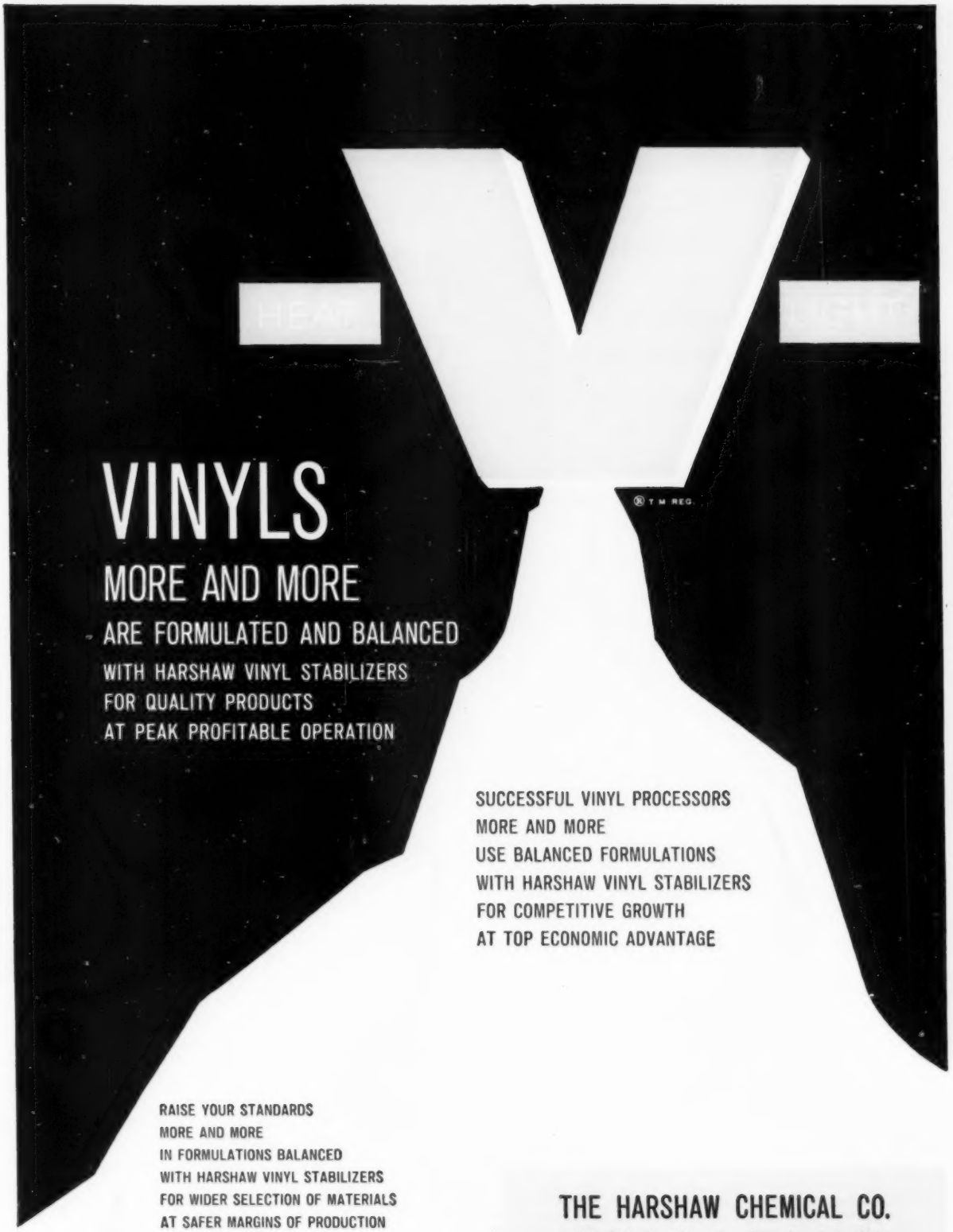
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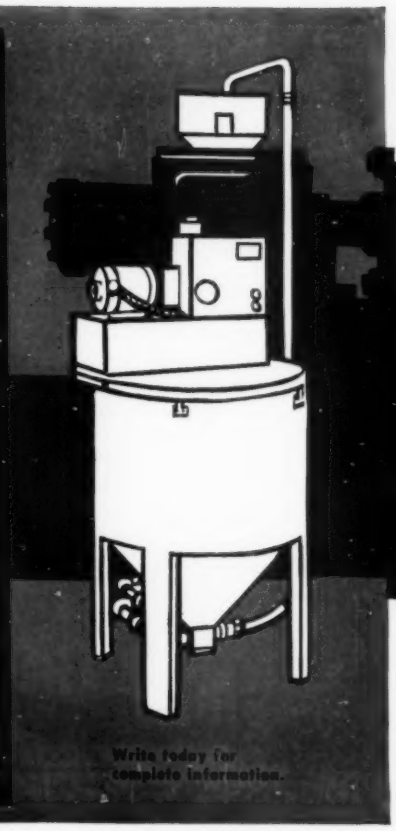

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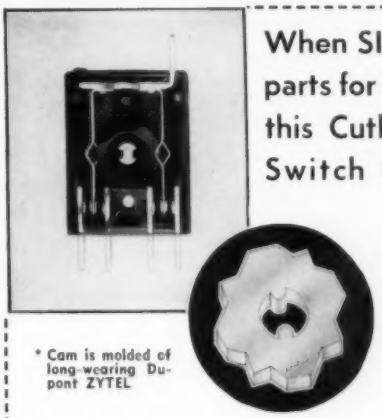

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(10 = best, 0 = poorest)

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Compatibility (roll spew)	6	5	6	7	9	5	10
Strength: tensile, modulus, elongation	7	6	7.5	7.5	8	7.5	9
Low Temp.: stiffness, brittle point	7.5	7.5	8.5	8.5	8.5	7.5	3.5
Stability: heat and light	8	8	7	8.5	7	6.5	8
Extraction: water, soap soln.	8.5	8.5	9.5	7.5	4.5	6	8
Extraction: oil (vegetable, mineral)	3.0	4	2	1	1	3	7
Volatility (carbon)	7	7	8	6.5	2.5	7	7
Relative Rating	47	46	48.5	46.5	40.5	42.5	52.5
Approximate Price Index* (Isosebacates = 100)	100	100	135	105	90	90	65

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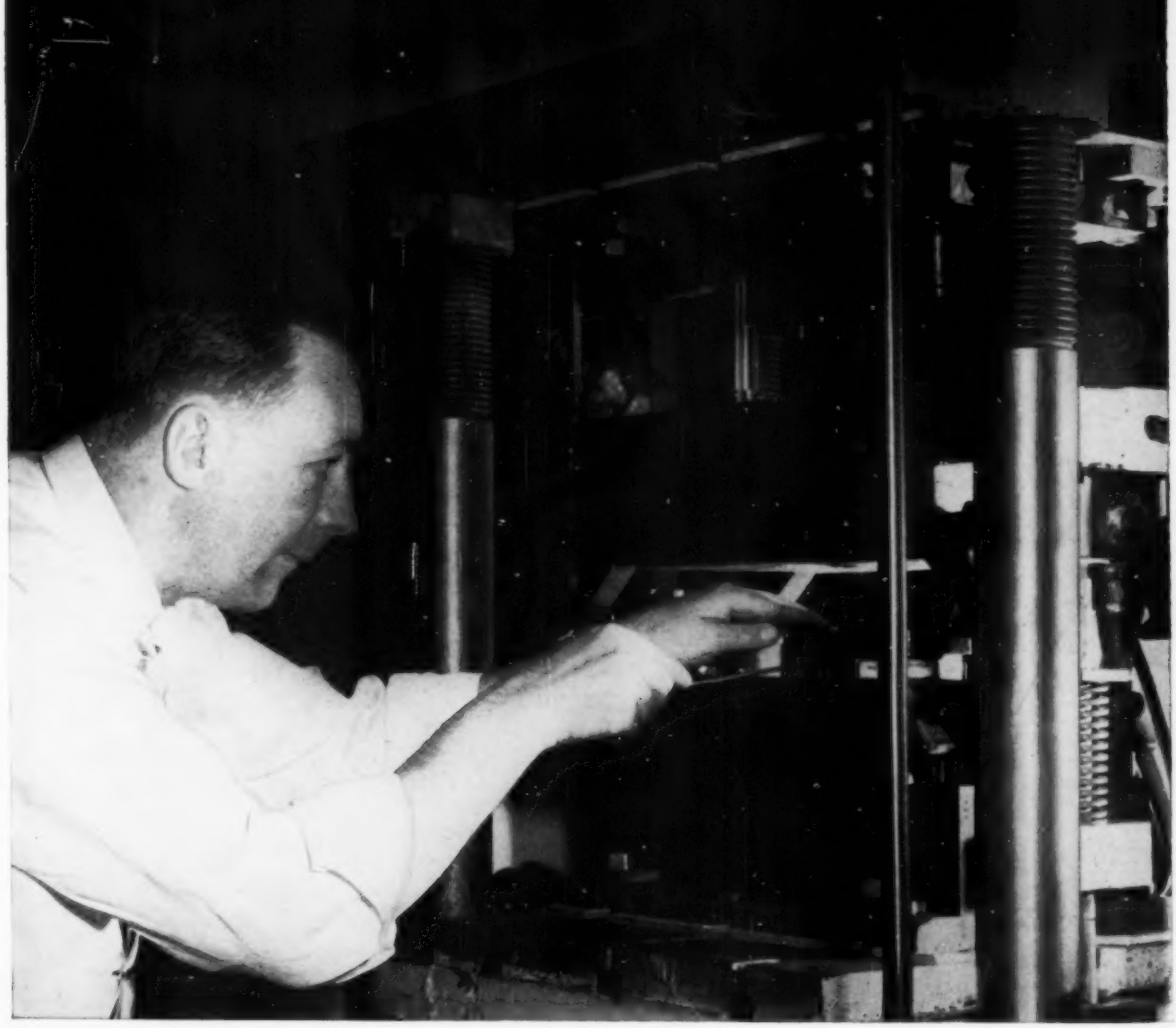
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